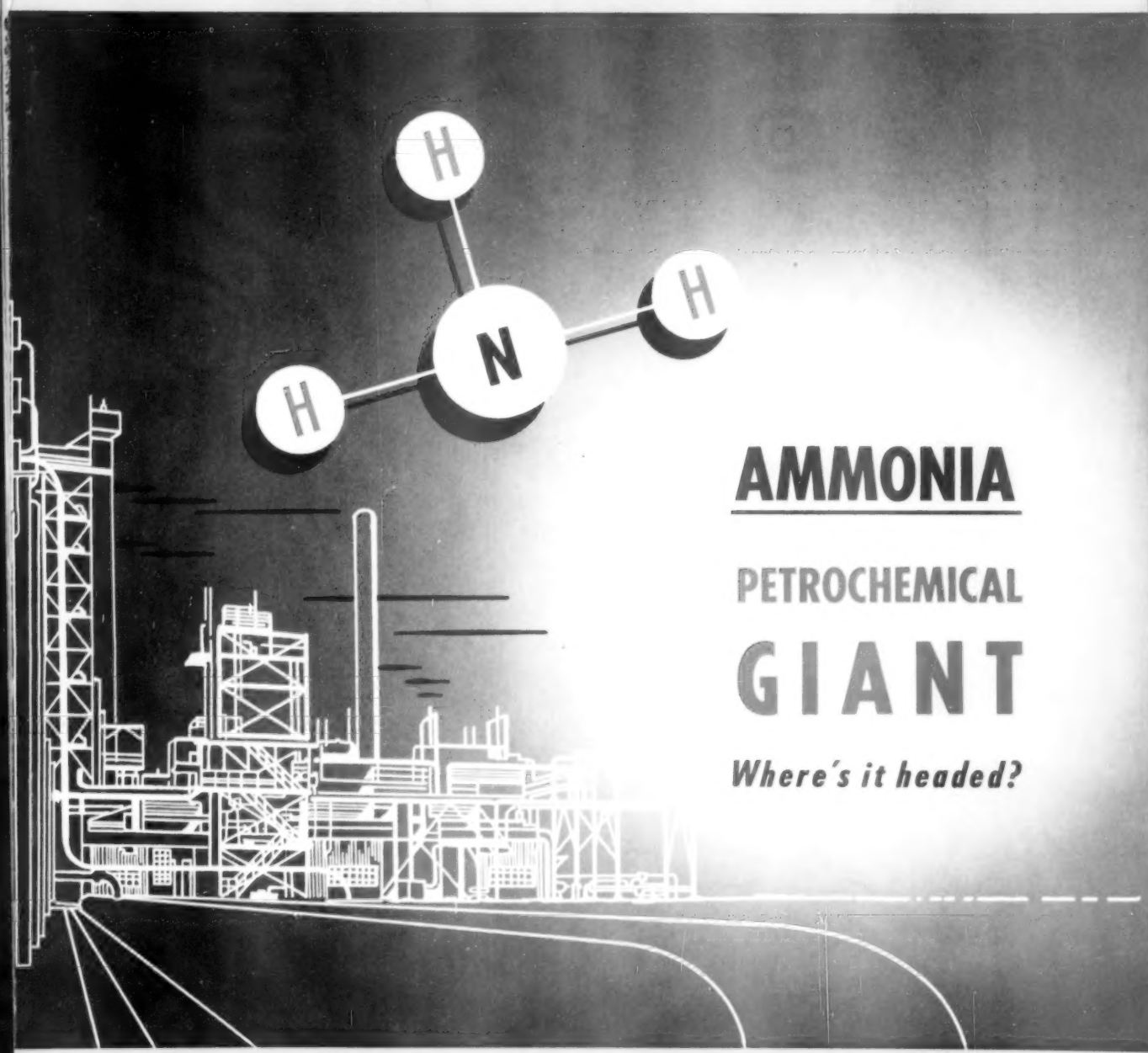
JANUARY 17, 1955

the OIL AND GAS JOURNAL



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The oil industry ups its ante on ammonia but will keep a wary eye on long-range picture.
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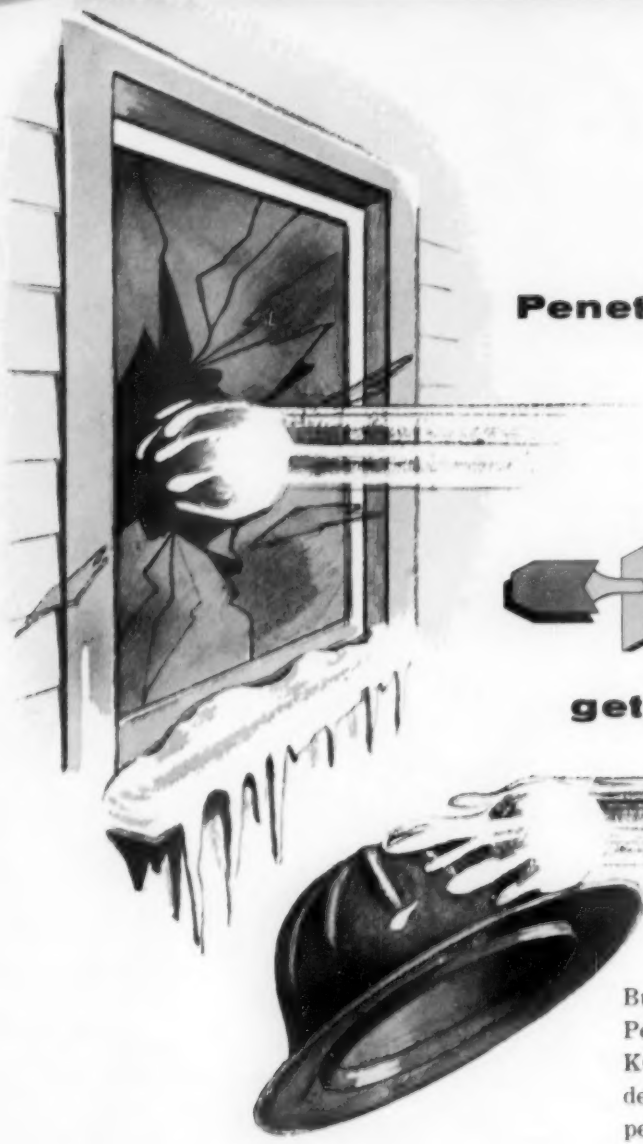

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In Brief . . .

1. STREAMLINED MAINTENANCE . . . A pump and driver schedule, a plot plan keyed to show every piece of equipment, and a card index showing the history of the equipment are used to streamline maintenance at La Gloria Corp.'s South Texas cycling plant. The pump and driver schedule is made up into handy booklet form, with fold-out sheets containing all pertinent data on various pumps and drivers in the plant.

2. CAT CRACKER OPERATION . . . How to improve the operation of your cat cracker is the subject of this report on the two panel discussions held recently by the Western Petroleum Refiners Association at El Dorado, Ark. Subjects covered include: (1) CO_2 to CO ratio . . . afterburning; (2) heat-balanced unit; (3) catalyst-to-oil ratio; (4) catalyst activity; (5) slurry recycle; (6) recycle gas oil; (7) decant oil; (8) thermal cracking cat cycle oils; and (9) materials of construction.

3. VENEZUELA CONSERVATION . . . Completion of its conservation plant, Tiajuana No. 1, by Creole Petroleum Corp. marks the first major step toward economic utilization of the gas produced in Bolivar Coastal field of Venezuela. The plant is located 7 miles offshore and built on a platform over the waters of Lake Maracaibo. It is unusual in many respects.

4. COST REDUCTION . . . Maintenance costs on electric beam-pumping motors can be reduced drastically by selecting equipment carefully and maintaining it through a well-balanced program. Comparative results show a maintenance cost of $3.25 per motor per month for an area that used this approach—against a cost of $6.30 per unit for a similar area that didn't.

5. GAS-TURBINE SPECS . . . A free-piston unit complete with power turbine, which develops 1,500 hp., weighs some 40,000 lb. A commercial reciprocating engine, now used extensively on pipelines, which develops 1,300 hp., weighs 110,000 lb. The two plants are virtually equivalent in power and in basic cylinder size. Free-piston unit performance corresponds to 92 per cent mechanical efficiency, as compared with crank-engine efficiency of 85 per cent maximum.

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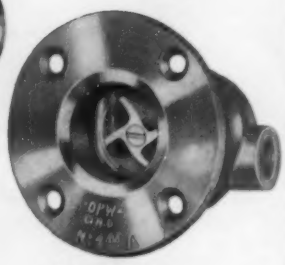

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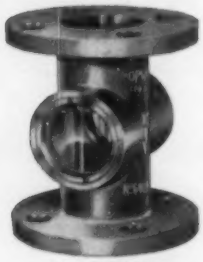

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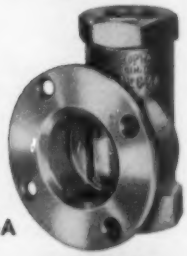

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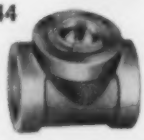

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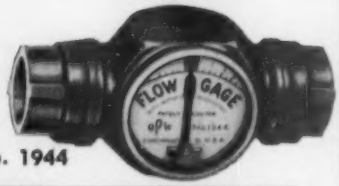

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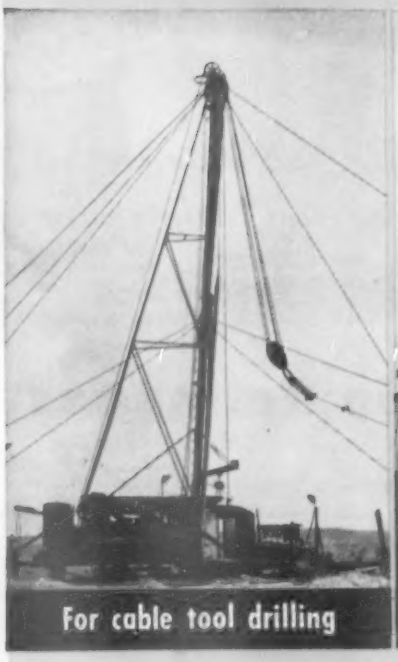

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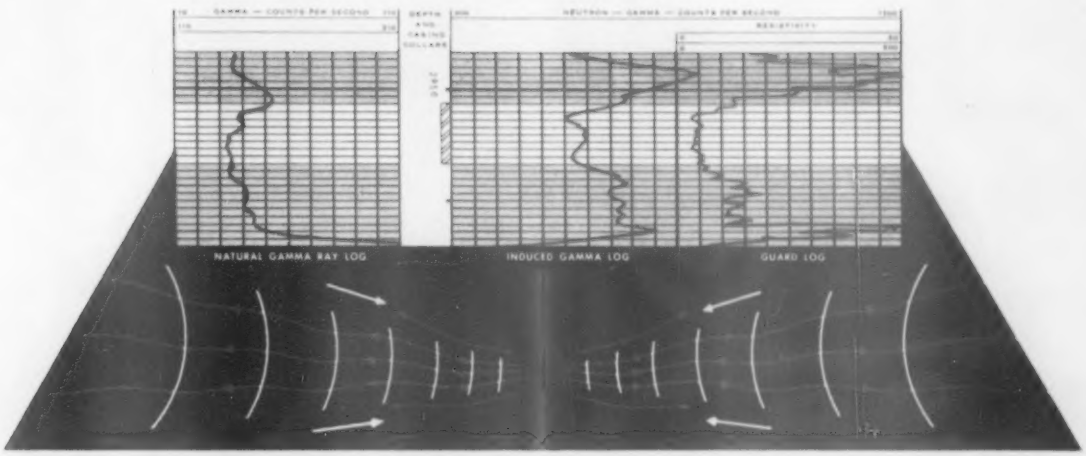

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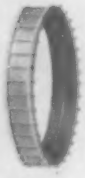

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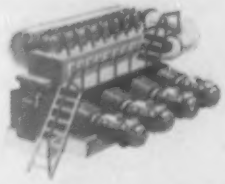

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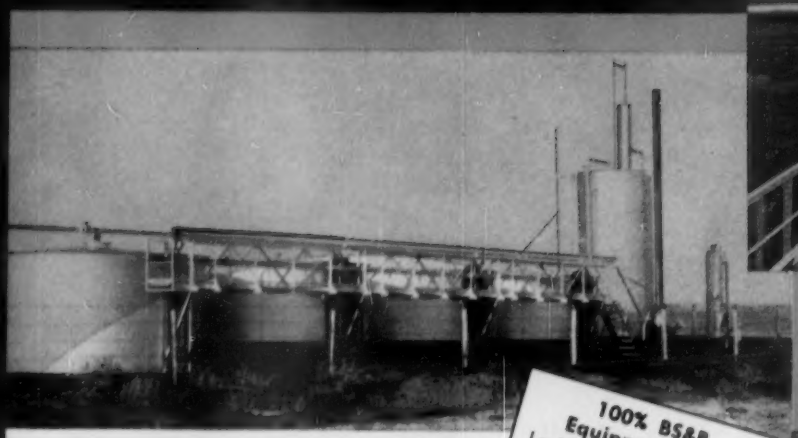

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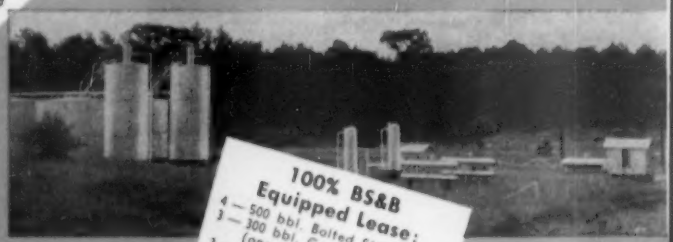

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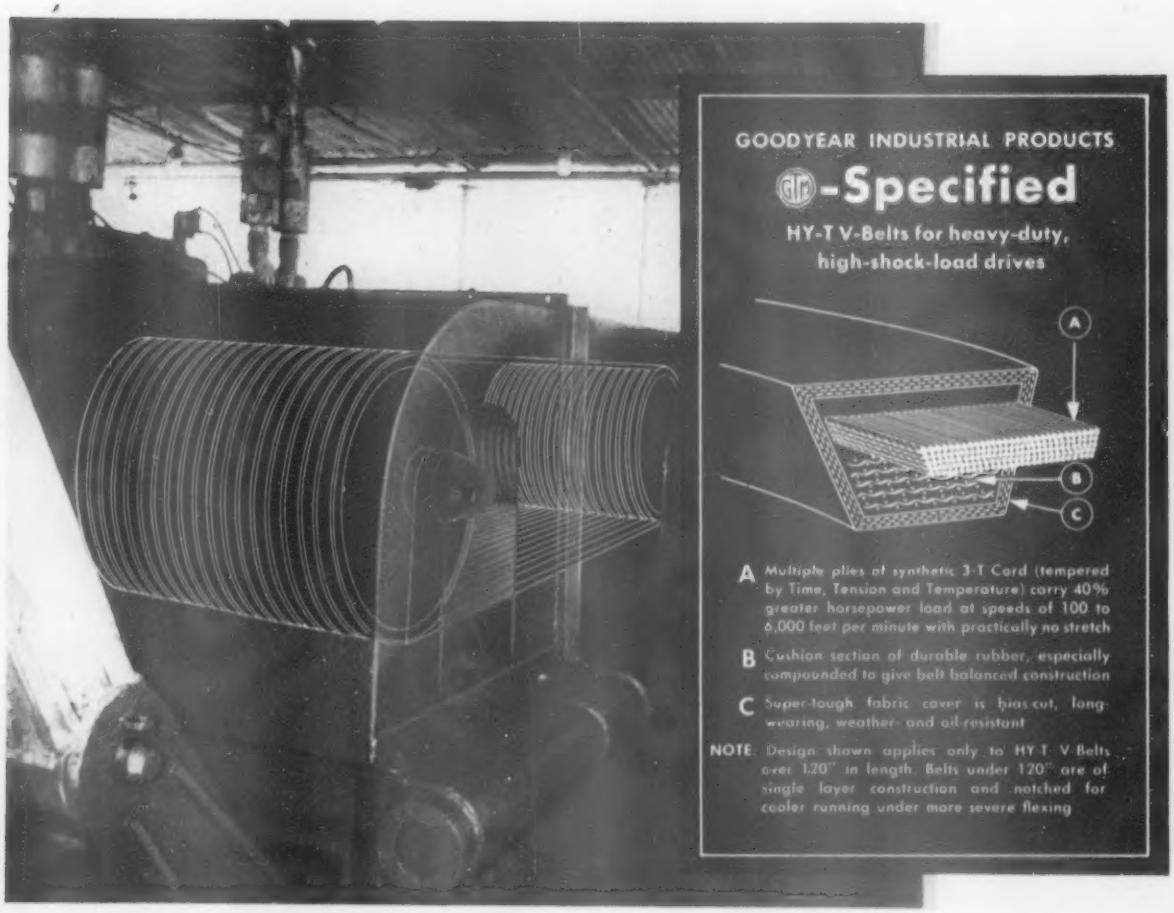
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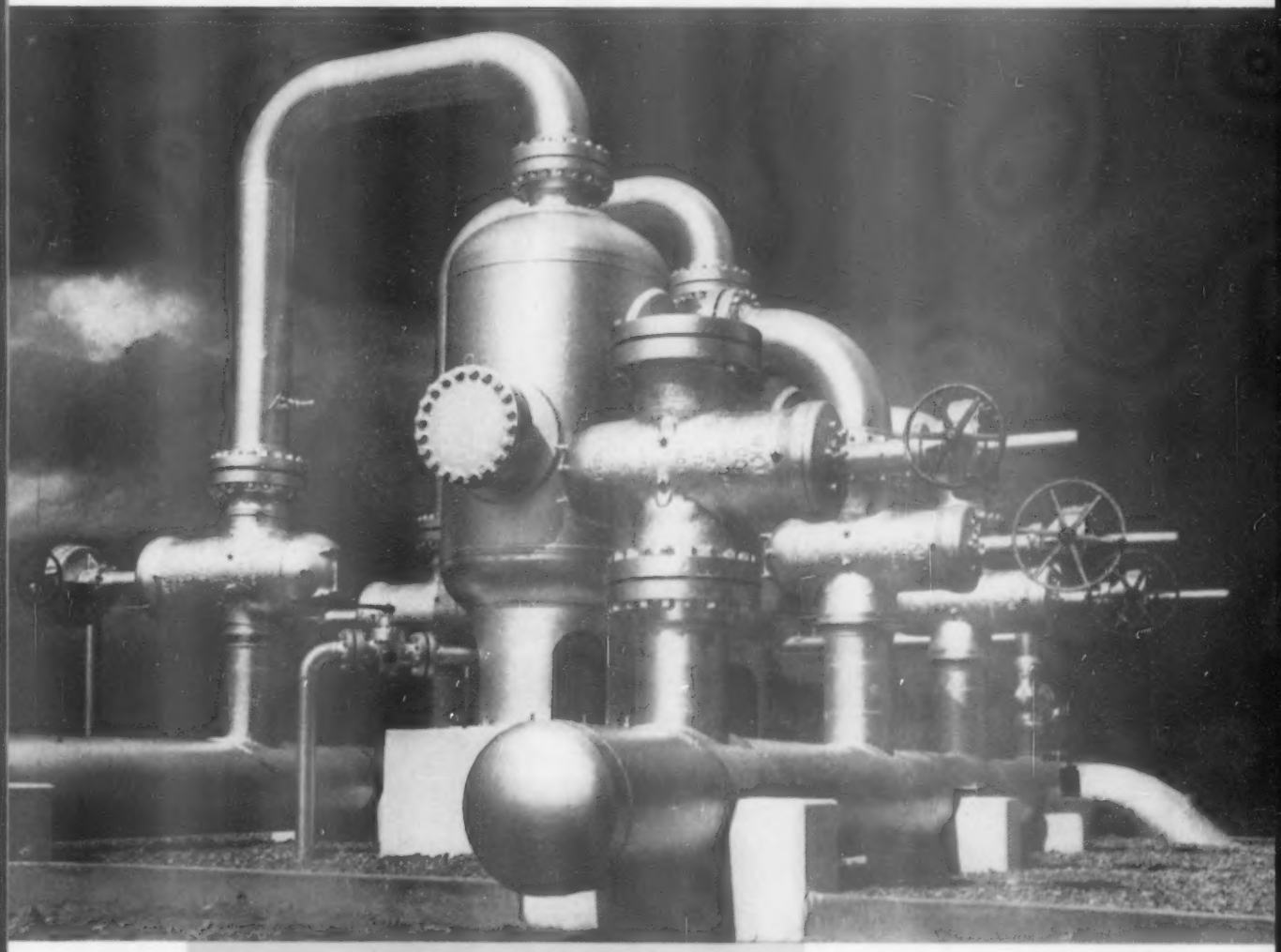


Scrubber Installation, Delhi, La.

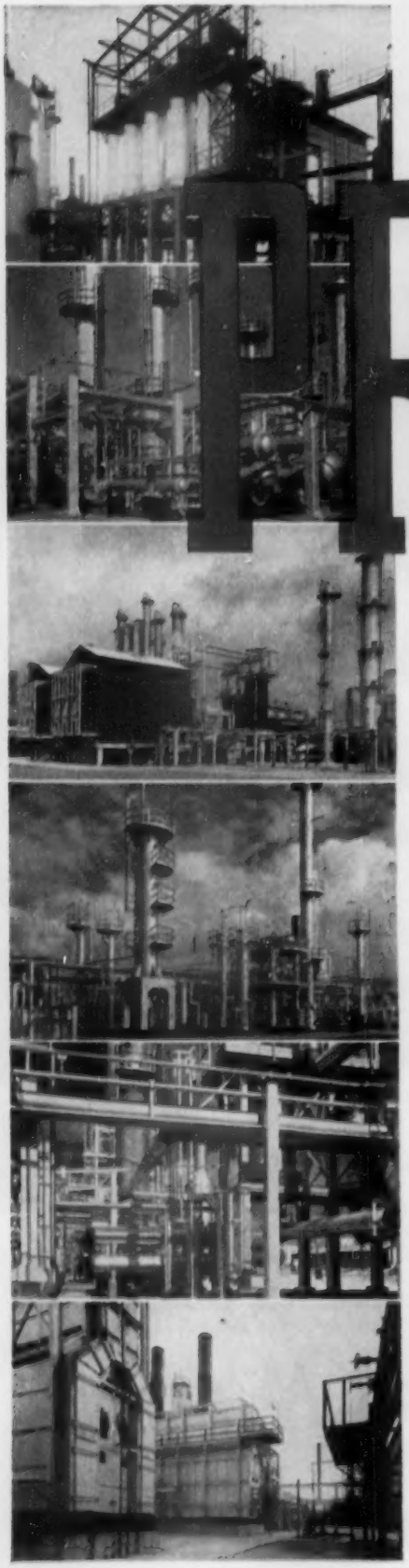
Most of the World's Most Modern Pipelines Are Tied Together with W-K-M Valves.

W-K-M Valves

W-K-M MANUFACTURING COMPANY, INC.

A SUBSIDIARY OF A.C.F. INDUSTRIES INCORPORATED

P. O. Box 2117 • Houston 1, Texas
Los Angeles, Calif.
Export Office: 45 Rockefeller Plaza, New York, N. Y.



CONSTRUCTION BY

PROCON

A company is as young as the unbounded energies and ambitions of the men who comprise its personnel . . . as old as their years of experience . . . and as competent as the sum of their proved capabilities.

Within the Procon organization, these factors add up to a substantial and impressive figure . . . a combination of assets that has enabled us to handle successfully a great many construction jobs of considerable magnitude and complexity . . . to do them efficiently and economically . . . with completions on schedule.

Procon is a well-rounded organization, fully equipped to handle all construction jobs in any part of the world. Procon service is complete . . . designing, engineering, procurement, construction. Procon clients are leaders of industry whose satisfaction is best expressed by the continuance of their patronage.

When your plans for the future include a construction project, talk it over with a Procon engineer. We believe you'll find it time well spent.

PROCON *Incorporated*

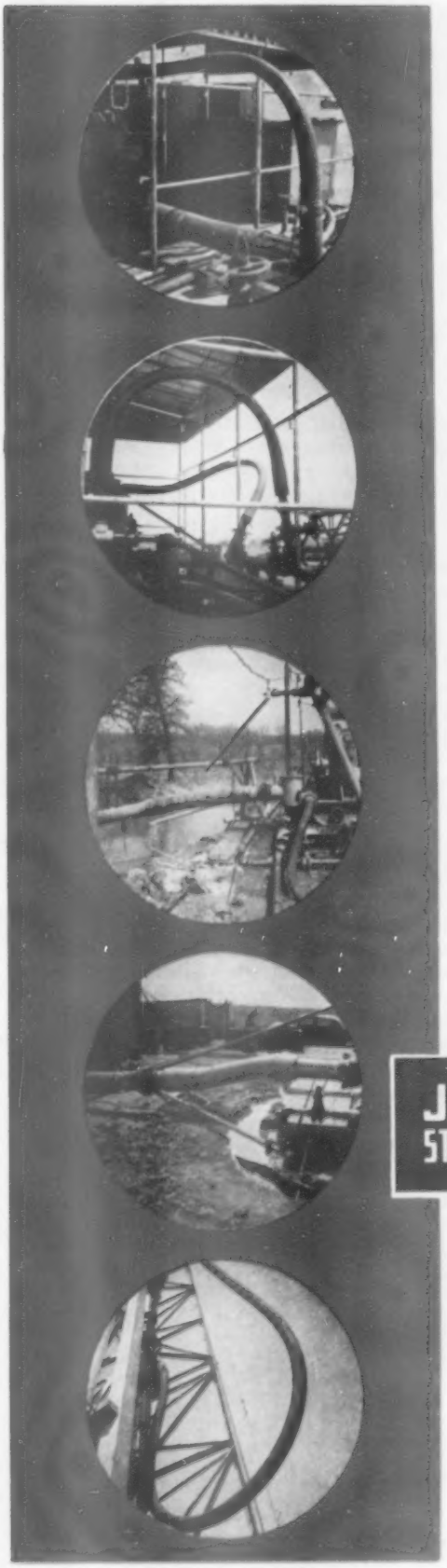
PROCESS CONSTRUCTION

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A.

AFFILIATED COMPANIES

PROCON (CANADA) LIMITED
40 ADVANCE ROAD
TORONTO 18, ONTARIO

PROCON (GREAT BRITAIN) LIMITED
112 STRAND, LONDON, W. C. 2



REPUBLIC
makes good hose

Hose around a drilling rig is like tires on a car. You want the best, but you don't always get the best because you simply haven't time to investigate.

So the availability of top quality hose becomes a J&L responsibility. Our field men observe and discuss hose performance on rotary rigs everywhere.

We prefer Republic, and without prejudice. There are many good brands on the market, but you can't get around that patented coupling on Republic Champion rotary hose – the higher the pressure the tighter the seal. And you can't get around the quality Republic builds into any hose . . . rotary, vibrator, suction.

For safety, for economy, and for the pure satisfaction of owning a premium product, buy your next hose from J&L.

Specify REPUBLIC *for better V-Belts, too.*

J&L STEEL

"...here's MY warehouse!"

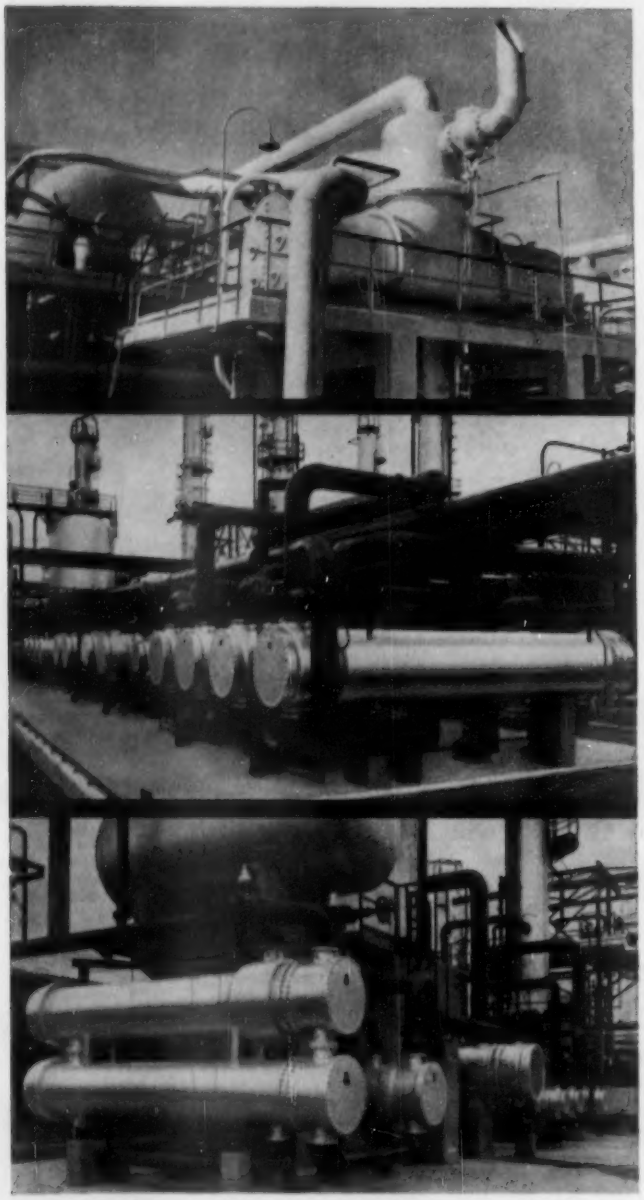
Jones & Laughlin
STEEL CORPORATION
SUPPLY DIVISION – TULSA, OKLAHOMA
Serving The United States and Canada

P·E·S·A
PARTNERS IN PETROLEUM PROGRESS

this...

ROSS

on your specially engineered exchanger means BONUS VALUES



Specially engineered exchangers designed and built by Kewanee-Ross embody features and services that have long been acclaimed throughout the refinery and petrochemical industries. "Bonus values" . . . they're called.

Characteristic Kewanee-Ross standardization is one of them. Substantial delivery time and savings in engineering costs can often be gained through the suitability of standard components for many specially engineered units.

A large stockpile of engineering experience is another. Kewanee-Ross engineers have had long experience with many special and unusual applications. Designing and production are off to a faster start.

Long a leader in the heat exchanger and surface condenser fields, Kewanee-Ross is today in the best position of its history to meet your requirements. Now, with the added capacity of a second large plant (Kewanee, Ill.), recently re-equipped with completely modern machinery and supervised by key "Ross trained personnel," Kewanee-Ross is ideally situated to supply all types of heat exchangers, built to any code, on a very favorable delivery schedule.

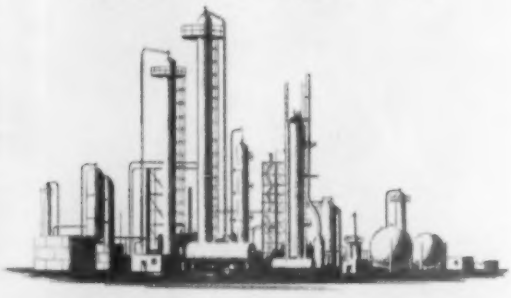
Arrange an immediate consultation with the Kewanee-Ross representative nearest you, at your earliest convenience. You have only your time to invest.

KEWANEE-ROSS CORPORATION

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

1417 WEST AVENUE • BUFFALO 13, N. Y.

In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont



Serving home and industry: AMERICAN STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

Sola-Flex joints control offset movement in Standard Oil's new El Segundo installation

INSTALLED in the new Model 4 catcracker at the El Segundo refinery of Standard Oil Company of California, this Sola-Flex assembly absorbs the movement of a 228 foot overhead line. A total of 10.88 inches of thermal growth in the pipe can be taken by this double-end Sola-Flex tied joint, and the end thrust of the bellows caused by pressure is not imposed on the piping system.

The photo shows how the tie bars guide and carry the weight of the center pipe section. Note the equal angulation of each set of bellows and the equal spacing of each U-span section . . . movement is controlled and stresses are uniform.

Sola-Flex expansion joints *are used and endorsed by all of the major oil companies.* They fully conform with API-ASME Codes. They are offered in a complete range of sizes in standard and special designs. And you gain the plus benefit of Solar research and engineering. Send for Sola-Flex catalogs today!

SOLAR AIRCRAFT COMPANY — SAN DIEGO, DES MOINES

DESIGNERS, DEVELOPERS AND MANUFACTURERS OF METAL ALLOY PRODUCTS

This is What Solar Offers You

Solar specializes in the manufacture of precision products from alloys and special metals for severe service. Solar's experience since 1927 is unduplicated in this field. Solar skills and facilities range from research, design and development through to mass production. Wherever heat, corrosion or difficult specifications are problems, Solar can help you solve them.

PLANTS. *In San Diego and Des Moines (photograph above). A total of 1,400,000 sq ft of floor space. Approximately 5,000 employees. Annual sales over $65,000,000.*

EQUIPMENT. *Production equipment for all types of metal fabrication —forming, machining, welding, brazing, casting, coating. Extensive laboratory and testing equipment. Facilities for development, prototype, limited or mass production.*

SERVICES. *Research, design, development, tooling and production engineering staffs. Experienced with all alloy steels, stainless alloys, super alloys, and titanium and its alloys. Government source inspection and Solar quality control meet rigid aircraft and commercial standards.*

CONTRACT PRODUCTION

Current orders include aircraft engine and airframe parts, alloy castings, pneumatic ducting, atomic energy components. Customers include some of the most honored names among aircraft and industrial companies in the U.S. and Europe.

SPECIAL PRODUCTS

Bellows. *"Sola-Flex"® bellows and expansion joints in many designs from ½ in. up to the world's largest, 28 ft in diameter.*

Gas Turbines. *Solar "Mars" 50 hp engines for auxiliary generator sets, ground carts, portable fire pumps; Solar "Jupiter" 500 hp engines in variable and constant speed models.*

Ceramic Coatings. *"Solaramic"® is the Solar trade mark for a family of coatings that protects metals from heat, corrosion, galling and abrasion.*

Controls. *Complete control systems utilizing the new Solar "Microjet"® principle for control of gas turbines, jet engines and pneumatic devices.*

FURTHER INFORMATION
Your inquiry regarding any Solar product or service will receive prompt attention. Address
Solar Aircraft Company
Department A-64
San Diego 12, California

This stem seat of plain carbon steel, removed from an Adjustable Wing Valve after only 45 days of service on a gas-condensate well, graphically illustrates the seriousness of corrosion.

After 7 years of continuous service on the same well, this stem seat of UNIBOLT "SA" Stainless Steel shows little, if any, harmful effect of the gas-condensate corrosion.

If CORROSION is your problem

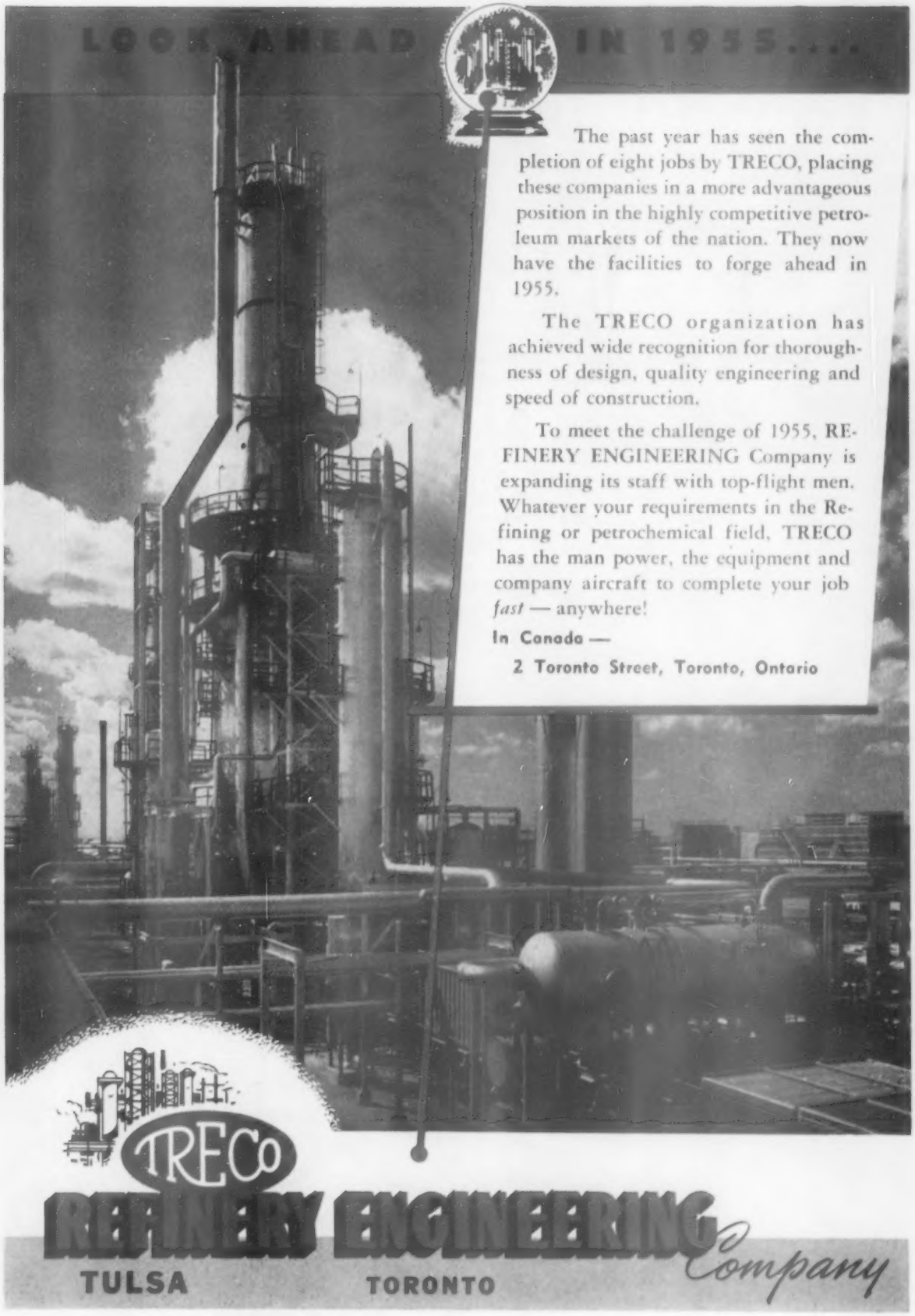
UNIBOLT "SA" Stainless Steel Christmas Tree Fittings may provide the answer. For the past seven years, in cooperation with a major oil company, UNIBOLT engineers have experimented with various stainless alloys to determine the one most resistant to gas-condensate corrosion. The un-retouched photographs above of identical parts tested on the same well clearly indicate the wisdom of selecting UNIBOLT "SA" Stainless Steel Fittings for corrosive conditions.

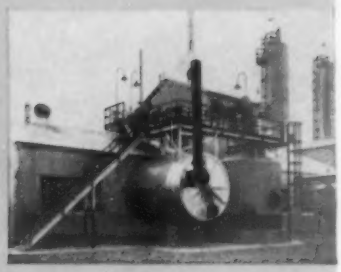
UNIBOLT "SA" STAINLESS*

THORNHILL CRAVER CO.

P. O. BOX 1184 HOUSTON, TEXAS

* Special Analysis, Special Heat-treatment


LOOK AHEAD IN 1955....
The past year has seen the completion of eight jobs by TRECO, placing these companies in a more advantageous position in the highly competitive petroleum markets of the nation. They now have the facilities to forge ahead in 1955.
The TRECO organization has achieved wide recognition for thoroughness of design, quality engineering and speed of construction.
To meet the challenge of 1955, REFINERY ENGINEERING Company is expanding its staff with top-flight men. Whatever your requirements in the Refining or petrochemical field, TRECO has the man power, the equipment and company aircraft to complete your job *fast* — anywhere!
In Canada —
2 Toronto Street, Toronto, Ontario
TRECO
REFINERY ENGINEERING Company
TULSA
TORONTO



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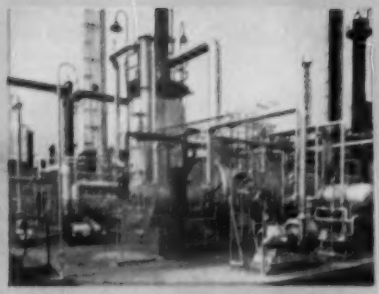
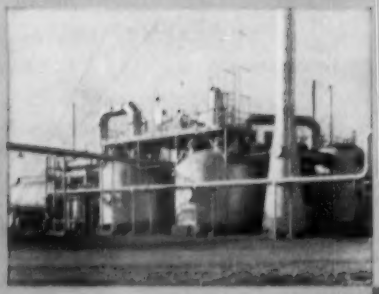
SULFUR PLANTS



by... **PARSONS**



75% of the contracts for plants to recover sulfur from H_2S in the United States and Canada during the past two years have been awarded to The Ralph M. Parsons Company.

Now under design for Tide Water Associated Oil Company on the East Coast is the largest sulfur recovery plant ever to be designed. This facility is expected to be on stream in 1956.

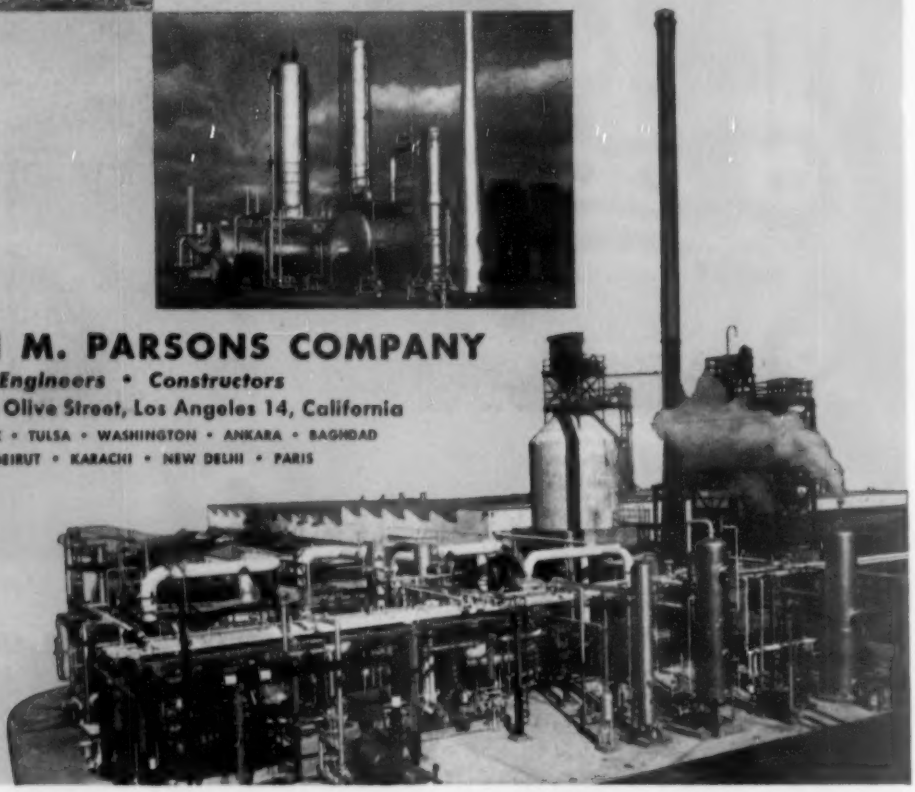
THE RALPH M. PARSONS COMPANY

Engineers • Constructors

617 South Olive Street, Los Angeles 14, California

NEW YORK • TULSA • WASHINGTON • ANKARA • BAGHDAD

BEIRUT • KARACHI • NEW DELHI • PARIS



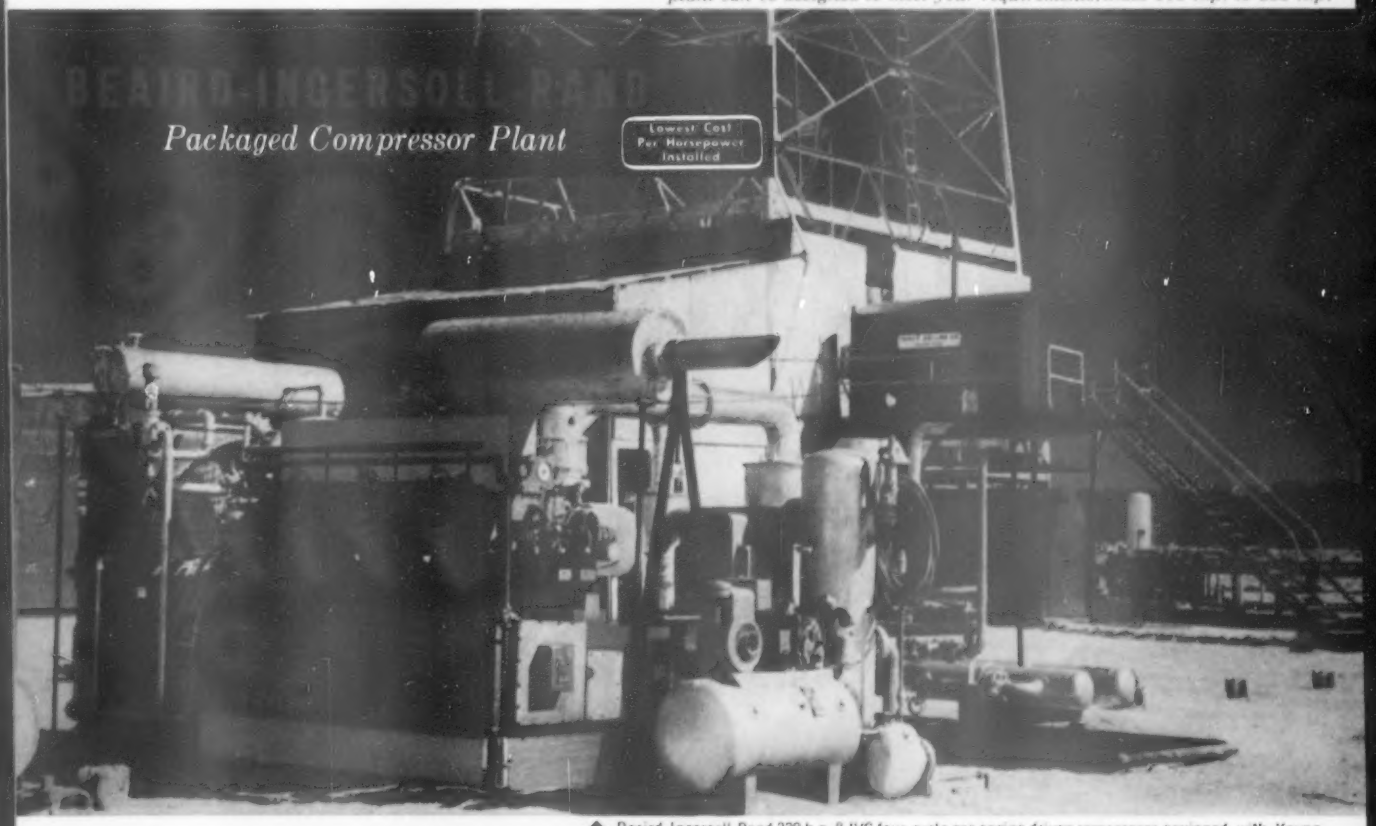
PACKAGED COMPRESSOR *SPEEDS* PENETRATION RATES ON TEST WELLS

OIL INDUSTRY TECHNOLOGISTS, investigating methods of reducing present-day drilling costs, recently started a series of tests using aerated mud. Of major importance to this program was the selection of a compressor. The unit had to deliver, automatically, full rated capacity over a wide range of pressures — to operate virtually unattended, leaving the crew free for regular duties. When moving it was essential that only oil field equipment be used and no special foundation required at the drilling site.

A Beaird-Ingersoll-Rand 4-Cycle Packaged Compressor Plant, 220 horsepower 8 JVG, was purchased by Phillips Petroleum Company for this task. Beaird engineers installed automatic controls that permit it to slow down or pick up speed over a range of 50% to 100% according to discharge conditions. A stop valve on the rig floor is all that is required to shut off air instantly for a connection or a trip. Other automatic controls safely handle this sudden change in operation — slowing the engine and unloading the compressor cylinders.

Mounted on its own heavy steel skid base, the compressor is set in a shallow pit near the rig and ballasted with sand or caliche. It moves as a single over-the-road package between drilling sites. On the new location only connections to fuel and mud lines are required to place it into operation.

Let us show you how a Beaird-Ingersoll-Rand packaged compressor plant can be designed to meet your requirements. Sizes 110 h.p. to 660 h.p.



▲ Beaird-Ingersoll-Rand 220 h.p. 8 JVG four-cycle gas engine driven compressor equipped with Young radiator and all necessary equipment and controls on Phillips Petroleum Company's drilling rig.

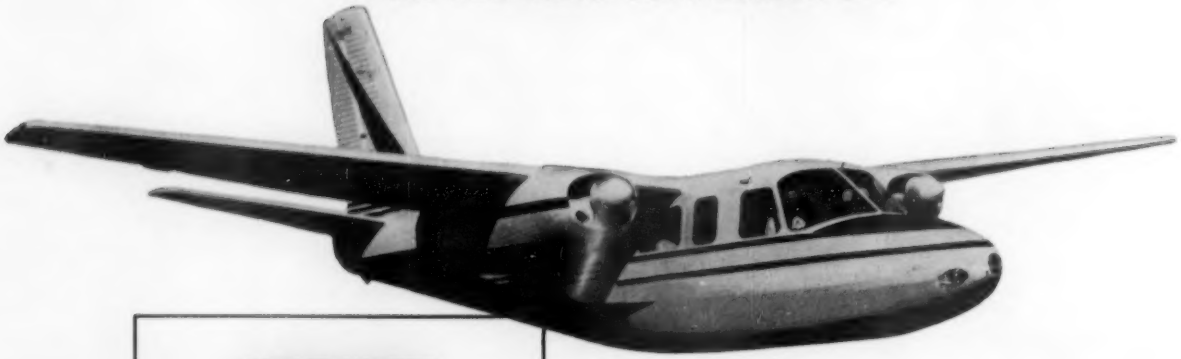
THE J. B. BEAIRD COMPANY, INC.
Shreveport, Louisiana

BEAIRD

MACHINING • MANUFACTURING • STEEL WAREHOUSE

Flying Comfort

in the new AERO COMMANDER 560



C. A. BENOIT, JR.
President
Permatex Company, Inc.

"One of the brilliant young executives of America, Mr. Benoit has made careful study and profitable use of business aircraft."

—FLYING, August, 1954

I estimate conservatively that my fatigue ratio in business flying has been reduced 50% by the Aero Commander operation.

C. A. BENOIT, Jr.

WRITE
DEPT. 120
FOR NEW
CATALOGUE

AERO DESIGN *Commander* 560

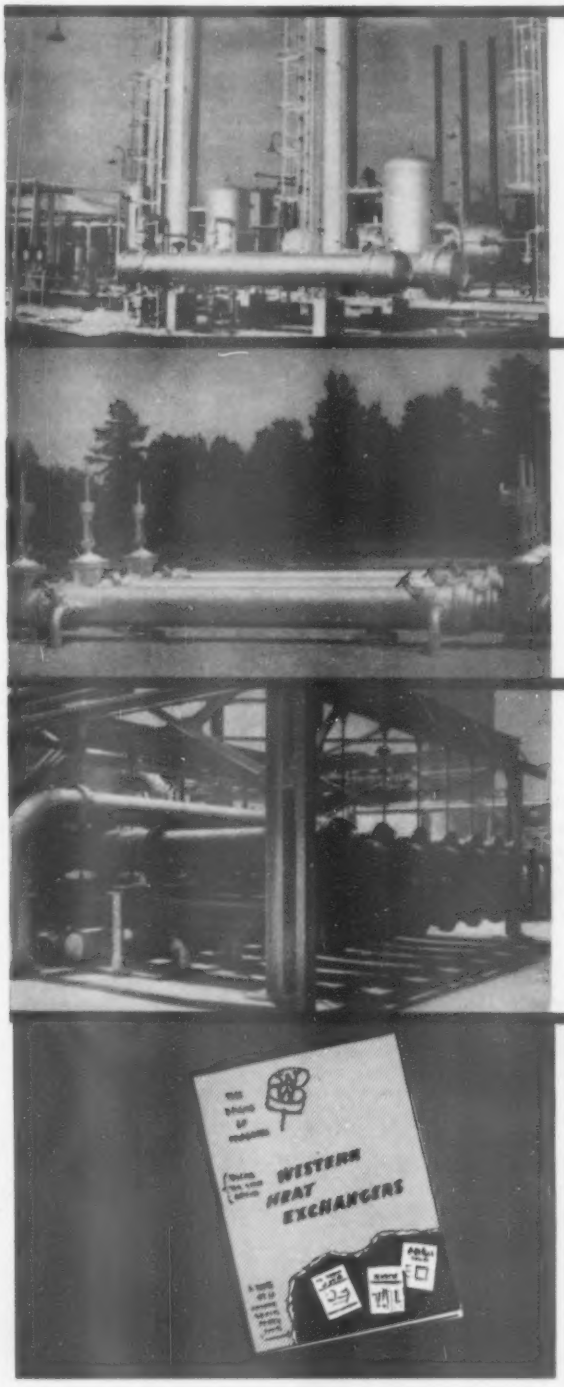
AERO DESIGN AND ENGINEERING COMPANY • TULAKES AIRPORT • P. O. BOX 118 • BETHANY, OKLAHOMA

"THE BRAND OF PROGRESS"

By Heat Exchanger Specialists

▲ SYNOPSIS OF AD #11: Before any coded heat exchanger is shipped from Western Supply, it is rigidly inspected by three experts — the insurance company's inspector . . . the customer's inspector . . . and Western's inspector. This inspection, which takes place during and immediately following the pressure tests, results in stamping the exchanger shell with the vital information concerning the equipment. This is the end of a continuous line of quality control within the Western plant. The inspector's seal of approval on the exchanger brands it for safe and efficient operation.

twelfth in a new series of advertisements



WESTERN Exchangers for Refineries

As designers and fabricators of all types of heat transfer equipment, Western Supply has attained stature within the industry. A great amount of equipment is in service throughout the process industries and the company's customers range from the smallest to the largest names in the petroleum and chemical fields.

WESTERN Exchangers for Pipelines

In its 20 years of building heat exchangers Western Supply equipment has figured prominently on practically every major crude oil, products, and gas transmission pipeline built. Because of its performance on these lines Western's reputation for efficient, well designed pipeline exchangers has become widespread throughout the United States and Canada.

WESTERN Exchangers for Chemical Plants

Western designs and fabricates shell-and-tube exchangers, atmospheric sections, telescopic exchangers, and reboilers for the refining, pipeline, chemical and petrochemical industries. The company is a member of the Tubular Exchanger Manufacturers Association, a group of independent heat exchanger manufacturers engaged in thermal and mechanical standardization of heat transfer equipment. For product quality . . . service flexibility — consult with Western Supply on your next heat exchanger requirements.

This concludes a series of 12 advertisements which we have titled, "The Brand of Progress". The series has been assembled under one cover and is available with our compliments upon your request. Please write for "The Brand of Progress", Western Supply Co., 2010 S. Utica, Tulsa, Okla.

WESTERN
HEAT EXCHANGERS

WESTERN SUPPLY COMPANY
P. O. BOX 1888 • TULSA, OKLAHOMA

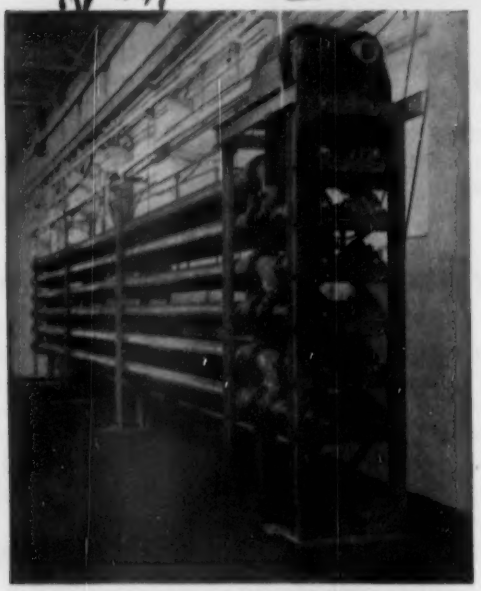
HUDSON-RUSH COMPANY—753 Gladstone Blvd., Shreveport, La.
130 Casa Linda Plaza, Dallas 18, Texas
PROCESS INSTRUMENTS & EQUIP. CO. - North Bldg., Charleston, W.Va.

Keep Heat Transfer Surfaces CLEAN...

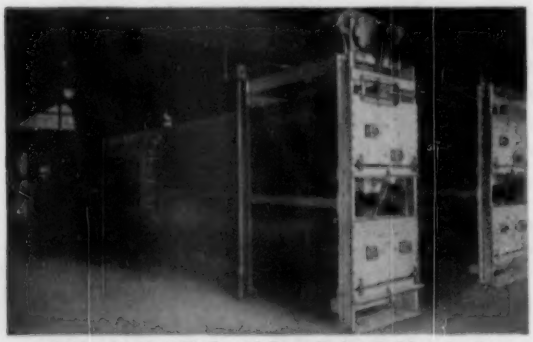
SPECIFY

Vogt

SCRAPED SURFACE *Exchangers*



*DOUBLE PIPE UNIT. Drive end close-up of 12 section unit under test in our shop.



*SHELL and PIPE UNITS. Two of five units installed in a leading petroleum refinery.

*Patented

IF you are all "gummed up" with a tough heat transfer problem, Vogt Scraped Surface Exchangers will provide the answer. They have patented scraper elements which prevent fouling of the heat transfer surfaces and insure the highest rate of heat exchange between the product and the cooling or heating medium. The scrapers also continuously agitate the fluid and assist removal of solids from the unit.

DOUBLE PIPE EQUIPMENT is available in two types; EXCHANGERS, for cooling with water, brine, and cold filtrate, and for heating with steam or hot liquids; and CHILLERS, for use with volatile refrigerants such as ammonia, propane, and Freon. Both types have 8" jacket pipes and 6" inner pipes with scrapers.

SHELL AND PIPE TYPE UNITS are designed for use with volatile refrigerants and for heating fluids with steam or similar heating mediums. They consist of large welded shells each containing seven 6" scraped pipe sections.

Vogt Scraped Surface Exchangers serve profitably as oil chillers, crystallizers, and heaters in many processes in the petroleum and chemical industries. Their application to your heat transfer problems will receive the prompt attention of our Engineering staff.

Write for Bulletin PE-1

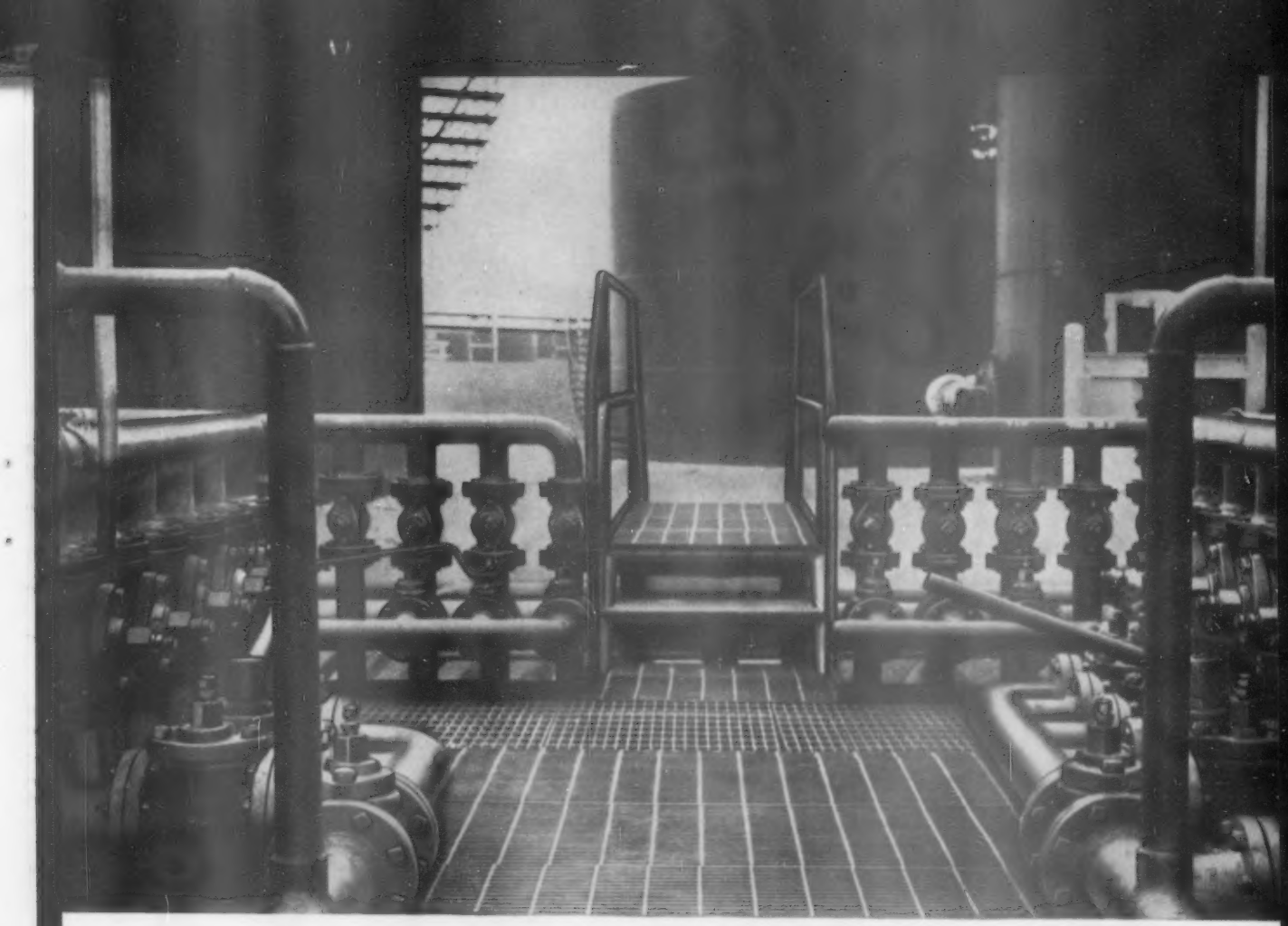
HENRY VOGT MACHINE CO.

LOUISVILLE 10, KENTUCKY

Branch Offices:

NEW YORK • PHILADELPHIA • CLEVELAND • CHICAGO

ST. LOUIS • DALLAS • CHARLESTON, W. VA.

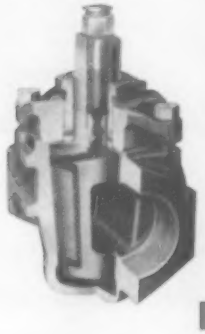


Costs Down...Production Up

because **Rockwell**-Nordstrom **Valves** perform better, longer, for less money!

In key spots, where dependability is vital, you *expect* to see Rockwell-Nordstrom valves. They were created forty years ago for the tough jobs ordinary valves couldn't handle.

But now you also see them—by the hundreds *and thousands*—in "routine" services like the tank manifold shown above, and for the same basic reasons:



—they're ruggedly dependable, yet cost no more than ordinary valves.

—they're pressure-lubricated, to provide a truly tight, dependable seal...

—the lubricant film prevents grinding metal-to-metal wear, means longer life, less downtime, lower maintenance cost ...

—quarter-turn, and the hydraulic-jack action of the lubricant, make them quick and easy to operate, once a day or once a year ...

Rockwell-Nordstrom is the *original* lubricated plug valve, and for 40 years has been the plug valve leader. That's why Rockwell can give you the most complete range of sizes, pressure-temperature ratings, body designs, and metals.

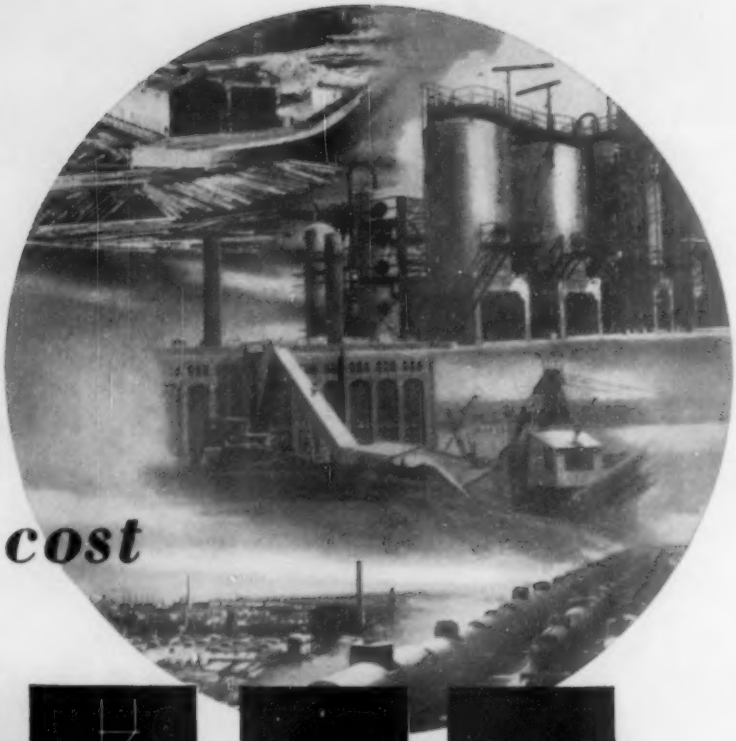
Why not standardize on Rockwell-Nordstroms—and genuine Rockwell-Nordstrom lubricants—for your fuel, products, supply and transfer lines? You'll get better valve service than you've ever had before, and at lower cost per year. Rockwell Manufacturing Company, Pittsburgh 8, Pa.

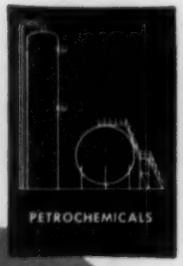
Canadian Valve Licensee: Peacock Brothers Limited.

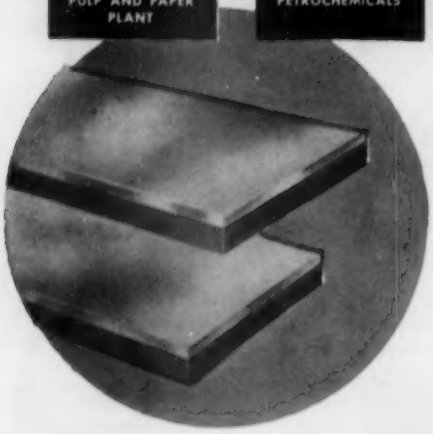
ROCKWELL-Nordstrom **VALVES**

LUBRICANT SEALED FOR POSITIVE SHUT-OFF

how to get Stainless Steel advantages ...*at lower cost*







If your fabrication problem involves corrosion resistance or protection against product contamination, it will pay you to investigate the economies made possible by Claymont Stainless-Clad Plates.

For numerous types of tanks, vessels and processing equipment, Claymont Stainless-Clad Plates give all the advantages of solid stainless steel—yet with substantial savings.

Produced in our plant to exacting standards, these plates are manufactured with painstaking care under personalized supervision. Our facilities provide definite assurance of prompt delivery. For detailed information write direct to Claymont Steel Products Department, The Colorado Fuel and Iron Corporation, 813 West Street, Wilmington 99, Delaware.

Claymont Steel Products

CF&I

Products of Wickwire Spencer Steel Division • The Colorado Fuel and Iron Corporation

2733

Abilene • Albuquerque • Amarillo • Atlanta • Boise • Boston • Buffalo • Butte • Casper • Chicago • Denver • Detroit • El Paso • Ft. Worth • Houston • Lincoln (Neb.) • Los Angeles
New Orleans • New York • Oakland • Odessa • Oklahoma City • Philadelphia • Phoenix • Portland • Pueblo • Salt Lake City • San Francisco • Seattle • Spokane • Tulsa • Wichita
CANADIAN REPRESENTATIVES AT • Edmonton • Toronto • Vancouver • Winnipeg

Other Claymont Products • • Carbon and Alloy Steel Plates • Stainless-Clad Plates • Manhole Fittings and Covers • Large Diameter Welded Steel Pipe • Flame Cut Steel Plate Shapes

Six New Booster Stations

DOUBLE PLATTE PIPE LINE CAPACITY

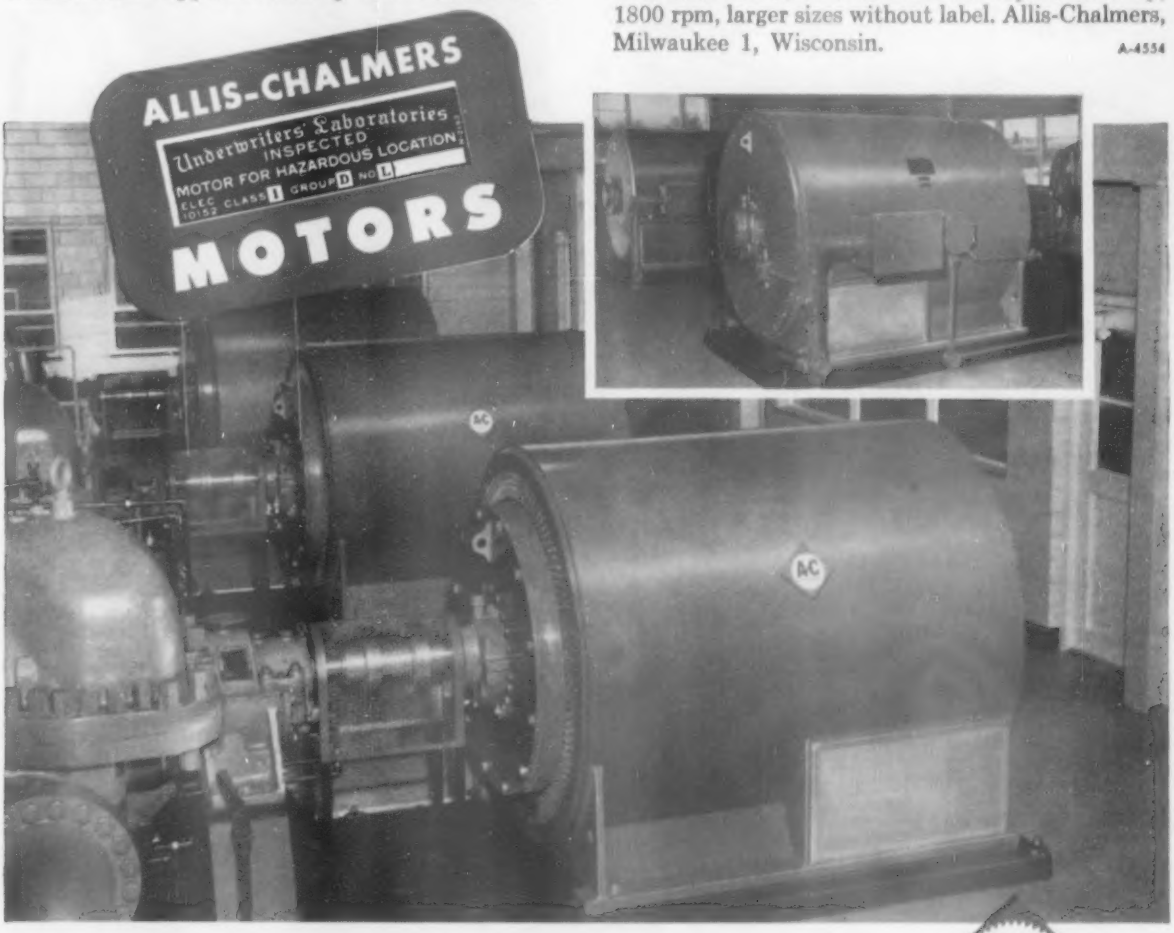
New stations use 1250-hp Allis-Chalmers Underwriters' approved motors. Similar design motors used in initial stations.

EIGHTEEN OF THESE 1250-HP MOTORS plus seven 900-hp and three 450-hp motors of similar design drive pumps in Platte Pipe Line Company's six new and three expanded stations on their line stretching from Wyoming to Wood River, Illinois. The original stations on this line were equipped with Underwriters' approved 800-hp A-C motors. This expansion program more than doubles line capacity without additional pipe. With motors, pumps, valves and other equipment controlled from Kansas City by microwave relay, only one attendant is required at each station.

Allis-Chalmers tube-type explosion-proof motors have proved their economy and dependability for both indoor and outdoor operation. Easy to clean tube-type air-to-air heat exchangers keep maintenance low. Heavy-duty construction takes round-the-clock pipe-line operation in stride.

Get complete information from your Allis-Chalmers District Office or write for Bulletins 05B7150 and 05R8189. Available with label up to 1250 hp, 1800 rpm, larger sizes without label. Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4554



Photos show station at Gower, Missouri. Five other stations have similar equipment. All are controlled by microwave relay from central dispatch office in Kansas City.

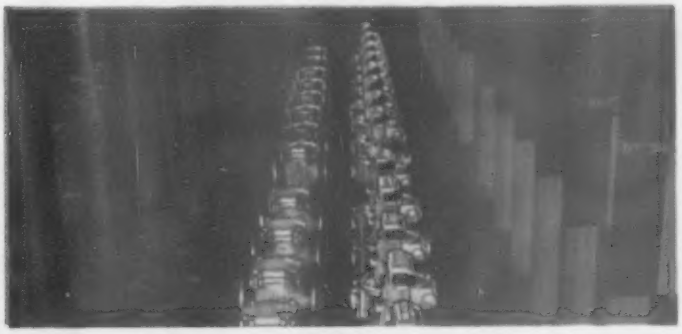
ALLIS-CHALMERS

He keeps oil on the go . . .

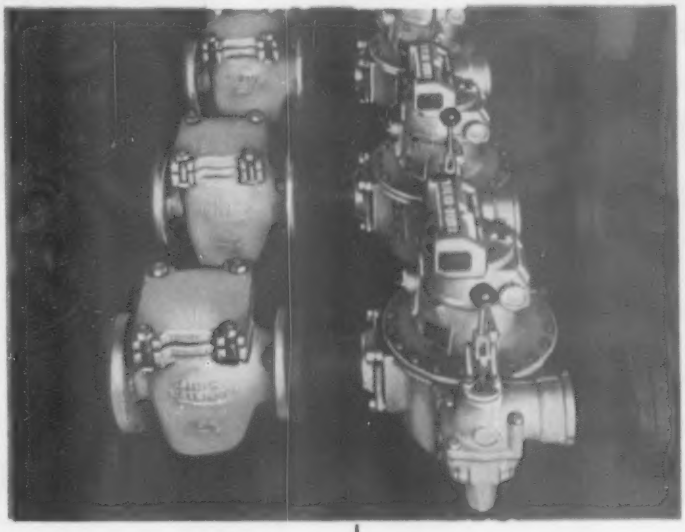
In the oilfields . . . at the refineries . . . on the pipelines, wherever oil is on the move, you'll see the man with the goggles and torch. New pipes need joining . . . old pipes need repairing . . . equipment needs to be kept up. That's where the welder comes in. He's on constant call. He has to be. Because there can't be the slightest hitch in the operation that helps make Texaco products always available all over America.

The Texas Company

TEXACO



Blending Lube Oil at less cost



Sixteen A. O. Smith T-15 Meters installed on main blending manifold at Gulf Oil Corporations modern canning plant at Charleston, S.C. Sixteen other T-15's are used in individual blending operations. All are equipped with Strainers, Horizontal Counters, Set Stop Counters and Automatic, Slow-Closing Set Stop Valves—all *functional* accessories which let you DO MORE WITH A. O. SMITH METERS.

Save time, space, tankage and manpower. Maintain quality through accurate control. Do all this by blending with A. O. Smith Meters, equipped with time-tested, functional, automatic Slow-Closing Set Stop valves.

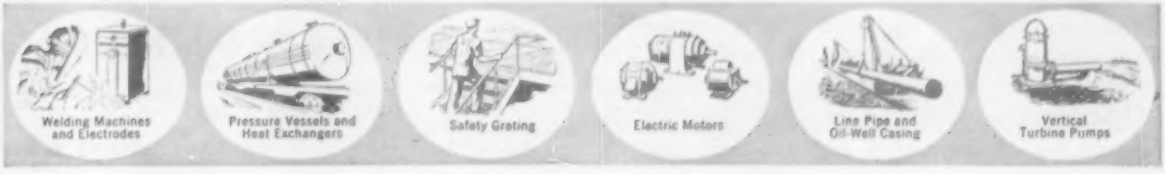
Get complete information from nearest representative.

Through research ...*a better way*

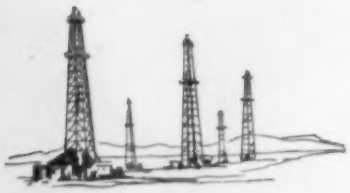
A.O.Smith
CORPORATION

METER DIVISION

Factories: 5715 Smithway St., Los Angeles 22, Calif., P. O. Box 500, Succasunna, N. J. Offices: Atlanta, Chicago 7, Houston 20, Los Angeles 22, New York 17. Canada: Toronto 12, Vancouver 1. International Division—Milwaukee 1, Wis.

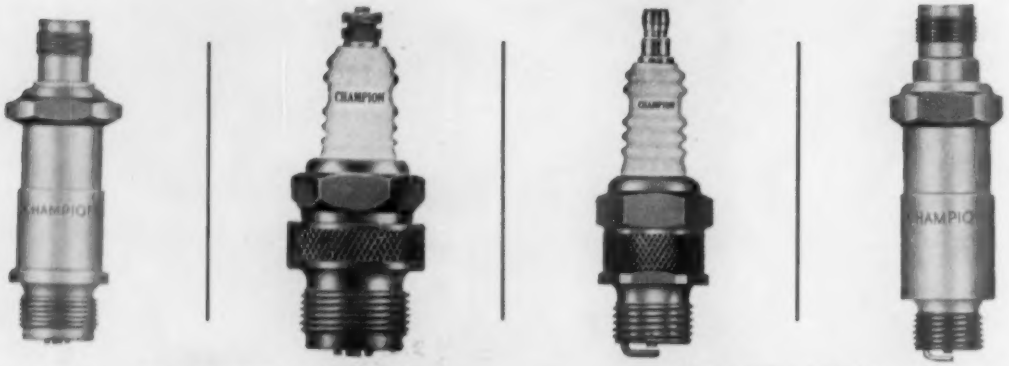


CHAMPION

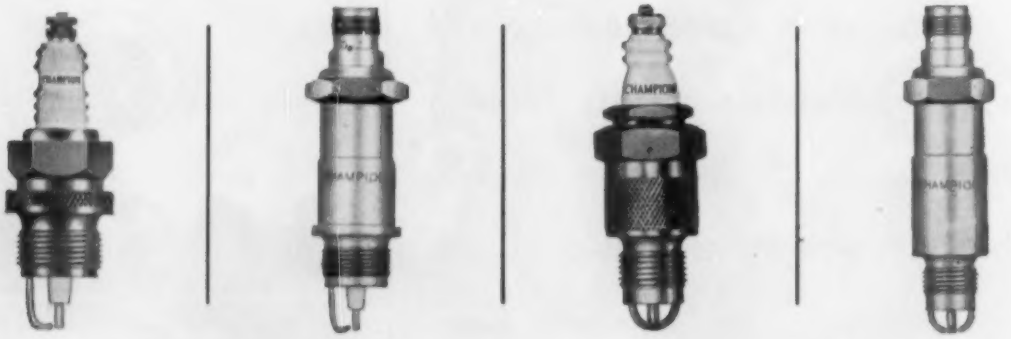


INDUSTRIAL AND OIL FIELD SPARK PLUGS ARE THE WORLD'S FIRST CHOICE FOR

Profits—Safety—Dependability!



E-901 GAS ENGINE 901 6 COM. GASOLINE UNITS E-6 COM.



44 DIESEL STARTING E-44 D-8 HESSELMAN ED-8

Shielded or unshielded to best suit your safety requirements, Champions are precision engineered for the specific job and have earned a reputation for long, trouble-free service life under the toughest conditions.

Only Champion offers a complete line of spark plugs for all industrial and oil field engines, gasoline, natural gas, Hesselman and diesel.

BEST FOR ANY ENGINE

CHAMPION

SPARK PLUGS

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Here's JEEP ENGINE RUGGEDNESS...

Willys POWER GIANT

4 and 6 CYLINDER *POWER UNITS*

From radiator to flywheel, there's long term ruggedness in this completely new Willys Power Unit. Each of its four choices of 4 and 6 cylinder POWER GIANT Engines has the famed Jeep "proven-in-action" features. There's positive crankcase ventilation, positive valve rotators, superb engine balance . . . and others . . . to give typical Willys low maintenance and high dependability. All the Unit's working parts are fully accessible through hinged top and removable side panels. Many variations of housing and equipment are available . . . write today for technical literature.

INDUSTRIAL ENGINES AND POWER UNITS

Model	Jeep	Hurricane	Lightning	Giant Hurricane
Cylinder and Head	4 L	4 F	6 L	6 F
Displacement Cu. In.	134.2	134.2	161.0	161.0
Range Max. bhp	22-60	22-70	28-75	28-90
Range of Speed	1200-4000	1200-4000	1200-4000	1200-4200

Complete Specifications
Ask for 4 cyl., 6 cyl. or Power Unit Bulletins.

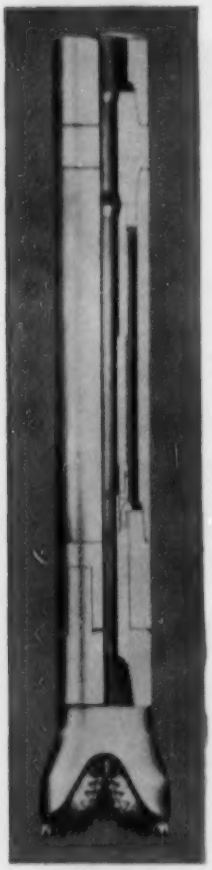
PROVEN IN ACTION

WILLYS MOTORS, INC. *Industrial Engine Department*

1475 North Cove Blvd. Toledo, Ohio

announcing the

NEW JOHNSTON HYDRAULIC hole caliper



Receiving sub in drilling position — positioned between drill collar and bit. Caliper instrument is dropped or pumped down just prior to pulling out of hole.

Gives you a NEW HIGH in accurate caliper logging — with a NEW LOW in rig time

This latest development of Johnston Testers, Inc., gives continuous measurement and recording of hole diameter, and eliminates drilling-rig down time.

Saves rig time because it eliminates time lost in rigging up and running wire line caliper.

The instrument is dropped into the drill pipe just before removing pipe. It measures and records as drill pipe is removed from the hole.

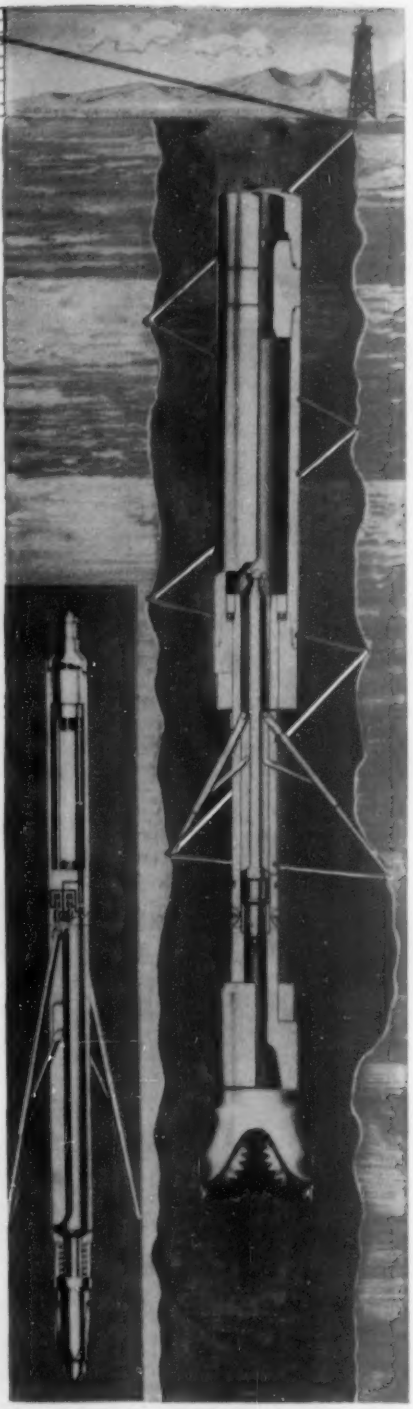
Logs while drill pipe is in the hole, free to circulate at any point. No delay or difficulty in crooked or directionally drilled holes.

Accuracy is assured because the Caliper is completely hydraulic, with integrated measuring arms that constantly measure maximum hole diameter, whether the Caliper is centralized in the hole or not.

Two-speed recording gives either a detail or a normal chart.

Let us give you all the facts about the new Johnston Hydraulic Hole Caliper and its many uses where extremely accurate measurement and recording of subsurface conditions are required.

WRITE OR CALL FOR FREE FOLDER



This is the Caliper instrument with cutaway view of the hydraulic system, clock and chart compartment.

Receiving sub is open and Caliper in measuring position. Caliper instrument unlocks sub as it is indexed in place.

JOHNSTON TESTERS

first in drill stem testing

HOUSTON, TEXAS

LOS ANGELES, CALIF • CALGARY, CAN.

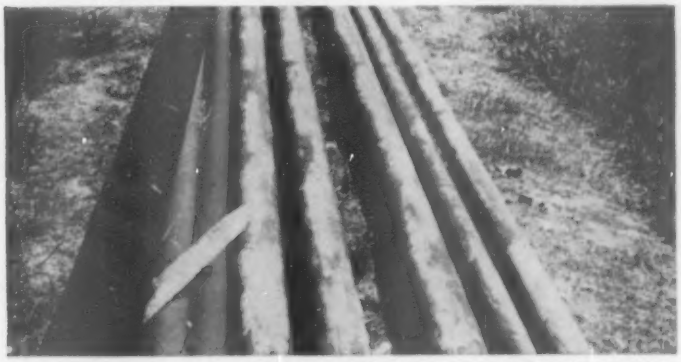
FORMATION AND CASING TESTING — JOHNSTON

HC 541

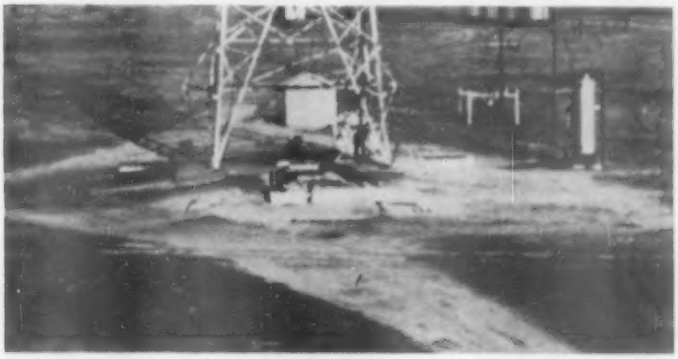
Weed and Brush Control lasts longer with Du Pont TELVAR® and AMMATE®

Weed Killers *Weed and Brush Killer*

Fire hazards are reduced around oil storages from thorough, long-term weed control with Du Pont "Telvar." "Telvar" is non-corrosive, won't harm application equipment.



Heavy weed growth was controlled with one application of "Telvar." "Telvar" keeps pipelines and key areas accessible, efficient to work around.



"Telvar" is ideal for weed control around derricks, pumps, storages. "Telvar" is easy to apply; extremely low in toxicity to humans and animals; non-flammable; and non-volatile.

One application of "Telvar" solves weed problems for a season or longer!

"Telvar" kills through the roots . . . prevents regrowth. Low dosages (20 to 80 lbs. per acre) make it cost little for the results you obtain. Low rates also mean less handling, less storage facilities. If you're looking for a way to cut maintenance costs to new low levels, include "Telvar" in your weed-control program. Available in two formulations: "Telvar" W; and "Telvar" DW, which is especially suited for light, sandy soils and in areas where annual rainfall is higher than 20 inches.

"Ammate" kills more kinds of brush and keeps it down longer than most weed and brush killers!

When the original spray job is well done, brush is kept under control with nothing more than an occasional spot spray later. You can rely on "Ammate" to do the job safely, even where your rights-of-way adjoin crop land, because "Ammate" is not volatile. There are no vapors to drift onto sensitive crops.

FREE ILLUSTRATED BOOKLETS describe how to control weeds and brush with Du Pont chemicals. For your copies, write to Du Pont, Grasselli Chemicals Dept., Rm. D 4032, Wilmington, Del. In Canada—Du Pont Company of Canada Limited, Box 660, Montreal.

TELVAR® AMMATE®

Weed Killers *Weed and Brush Killer*

On all chemicals always follow directions for application. Where warning or caution statements on use of product are given, read them carefully.

DU PONT

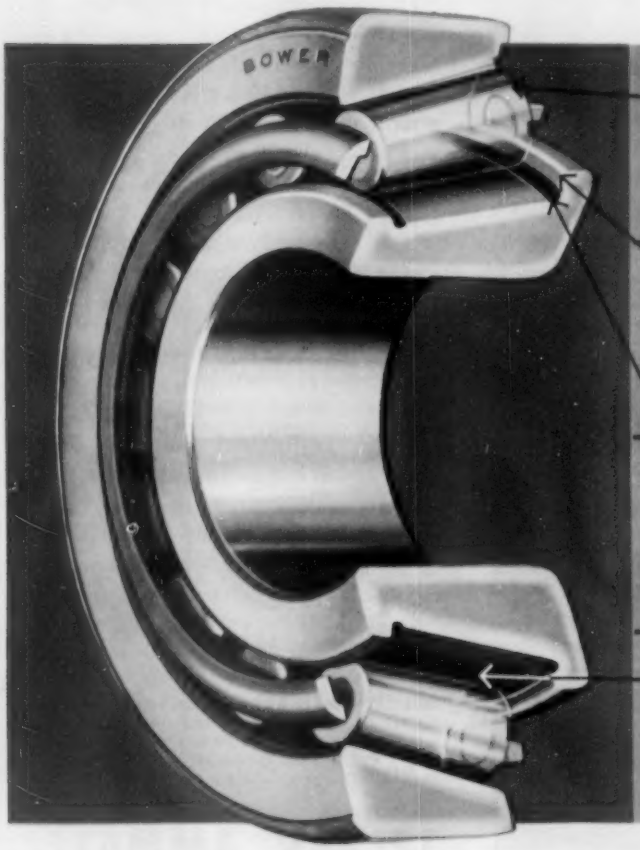
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Here's how BOWER Spher-o-honed design lengthens bearing life... cuts maintenance costs!

The Bower tapered roller bearing design features shown on this page are vitally important to every bearing user. For they illustrate the high quality, precision workmanship and close attention to engineering detail that go into *every* Bower bearing. Even more important, these Bower design features will give you significant bearing advantages such as reduced wear, longer bearing life and lower maintenance requirements. They've been thoroughly *proved* by extensive use in virtually every type of bearing application. If your product uses bearings—whatever it may be—specify Bower now. Or better yet, call in a Bower engineer while your product is still in the blueprint stage.

BOWER ROLLER BEARING COMPANY • DETROIT 14, MICHIGAN



● **SPHERICAL ROLLER HEADS ARE GENERATED TO THE CONTOUR THEY ACQUIRE IN THE COURSE OF WEAR.** This helps Bower bearings hold adjustment and pre-load longer and better. Normal running-in time is virtually eliminated.

● **HIGHER FLANGE PROVIDES A LARGE, TWO-ZONE CONTACT FOR ROLLER HEADS,** thereby reducing unit pressure. This exclusive Bower feature improves roller alignment, greatly reduces wear and practically eliminates resultant "end play."

● **LARGER OIL GROOVE GIVES POSITIVE LUBRICATION** at the critical point—where the roller head thrusts itself against the cone flange. Here Bower design provides a larger recess that holds a generous supply of lubricant—increasing efficiency and decreasing wear.

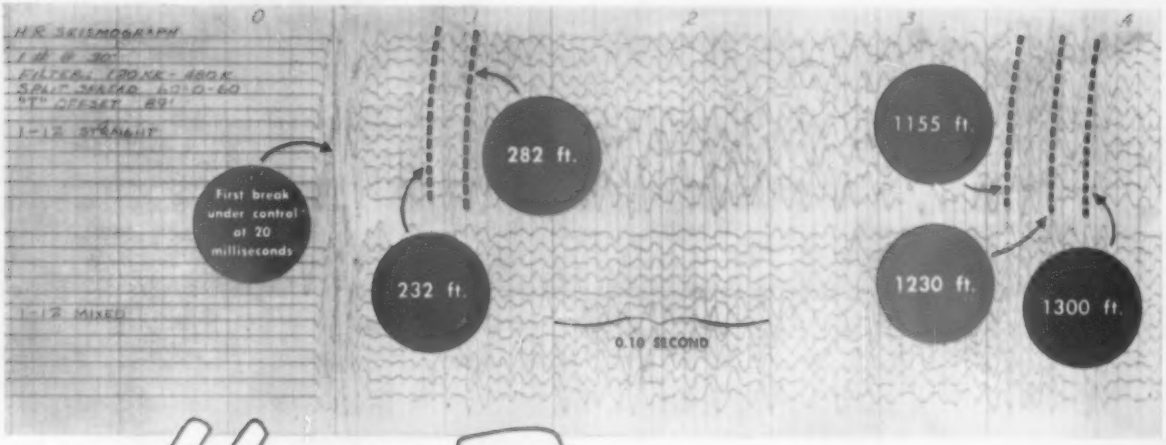
● **PRECISION RACES PROVIDE QUIETER, SMOOTHER OPERATION.** A Bower-developed grinding and honing process provides a micro-smooth surface of hard, crystalline base metal. In this way, close-tolerance precision is built-in to stay! No final adjustment is needed!

A COMPLETE LINE OF TAPERED, STRAIGHT AND JOURNAL ROLLER BEARINGS FOR EVERY FIELD OF TRANSPORTATION AND INDUSTRY

BOWER

ROLLER BEARINGS

SPHER-O-HONED



High Resolution

here's a new record for near-surface seismic data

If you're plagued with the problem of obtaining accurate near-surface seismic data, look carefully at the record illustrated here. With first breaks under control in 20 milliseconds, a reliable reflection was obtained at a depth of 232 feet. This record is typical of the results obtained by the new Houston Technical Laboratories High Resolution Seismic System. A major development in geophysical prospecting, the HTL portable HR System now makes possible reliable reflection surveys over a depth range of 100-2500 feet. It is especially designed for use in petroleum exploration, mining, ground water location, and civil engineering where shallow seismic information is vital.

WRITE for Technical Bulletin No. S-303 for additional information about how you can now make reliable *shallow reflection* surveys.

use the HTL portable HR seismic system to:

- establish near-surface velocity control
- obtain near-surface structural data
- supplement core-hole information

HTL

HOUSTON TECHNICAL LABORATORIES

A SUBSIDIARY OF TEXAS INSTRUMENTS INCORPORATED

2424 BRANARD • HOUSTON 6, TEXAS, U.S.A. • CABLE: HOULAB

PARKERSBURG PREFABRICATED STEEL BUILDINGS

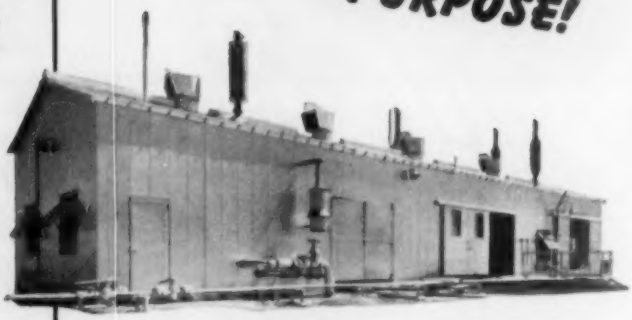
ECONOMICAL!

FLEXIBLE!

FOR EVERY PURPOSE!

ALL SIZES!

ATTRACTIVE!



ECONOMICAL! They cost up to 30% less than concrete block or brick buildings . . . require only minimum care and maintenance . . . quickly erected.

FLEXIBLE! Original structure can be expanded by addition of standard units at low cost. Designed to meet almost any floor plan. Available in structural, non-structural and multiple-type buildings.

ATTRACTIVE! Architecturally and structurally, Parkersburg Prefabricated Steel Buildings fit into any residential or industrial environment. The possibilities for adding special fronts are unlimited.

ALL SIZES! You can get Parkersburg Buildings in heights, widths and lengths, to meet every dimensional requirement.

FOR EVERY PURPOSE! Parkersburg Prefabricated Steel Buildings are available for every oil industry need. Ask your nearest representative or write for Steel Building Catalog SB-6-53.

PESA

5429

THE PARKERSBURG RIG & REEL COMPANY • PARKERSBURG, WEST VIRGINIA

Division of Parkersburg-Aetna Corporation

PIPE LINE PROGRESS

298 MILES OF A. O. SMITH LINE PIPE

helps Service Pipe Line transport "crude" from the Rockies

Service Pipe Line Company now provides a new outlet for Rocky Mountain and Williston Basin Production. Starting at Fort Laramie, Wyoming, the line traverses the southeastern part of the state, Southwestern Nebraska, Northeastern Colorado and the State of Kansas, with a small segment in Western Missouri which connects with Service Pipe Line Company's main North-South system. The initial capacity of the line is to be 160,000 barrels a day. Eventually capacity will reach 200,000 barrels.

It will transport crude oil produced in Wyoming and other sections of the Rocky Mountain area, the Denver-Julesburg Basin and the production of Western and West-central Kansas.

A. O. Smith supplied almost half the 628 mile line — a total of 298 miles in 20 inch and 22 inch diameters. To meet Service Pipe Line's schedules, this pipe was shipped simultaneously from both A. O. Smith Corporation at Milwaukee and A. O. Smith Corporation of Texas.

For over 26 years A. O. Smith has practiced a rigid and high-standard quality control over exacting manufacturing specifications. That's why A. O. Smith pipe made and installed in 1928 is still in operation. That's why nearly every important high pressure line is wholly or in part A. O. Smith pipe.

A. O. Smith line pipe is available in a complete range of sizes and wall thicknesses — from 8⅝ in. to 30 in. diameters.

A. O. Smith also makes the famous "SW-80", E-7010 electrode for field welding of line pipe. Just one electrode for stringer, hot, filler and finish passes.

Through research ...a better way

A.O.Smith

CORPORATION

TUBULAR PRODUCTS DIVISION

Milwaukee 1, Wisconsin

Chicago 4 • Dallas 2 • Houston 2 • Los Angeles 22 • Midland 5, Texas • New Orleans 12 • New York 17 • Pittsburgh 19 San Francisco 4 • Seattle 1 • Tulsa 3 • Washington 6, D.C.

International Division: Milwaukee 1

CARBIDE

the NAME to keep in mind

...for MONOETHANOLAMINE DIETHANOLAMINE DIETHYLENE GLYCOL TRIETHYLENE GLYCOL

You get *more* than gas-treating chemicals when you specify CARBIDE . . .

You get these extra benefits...

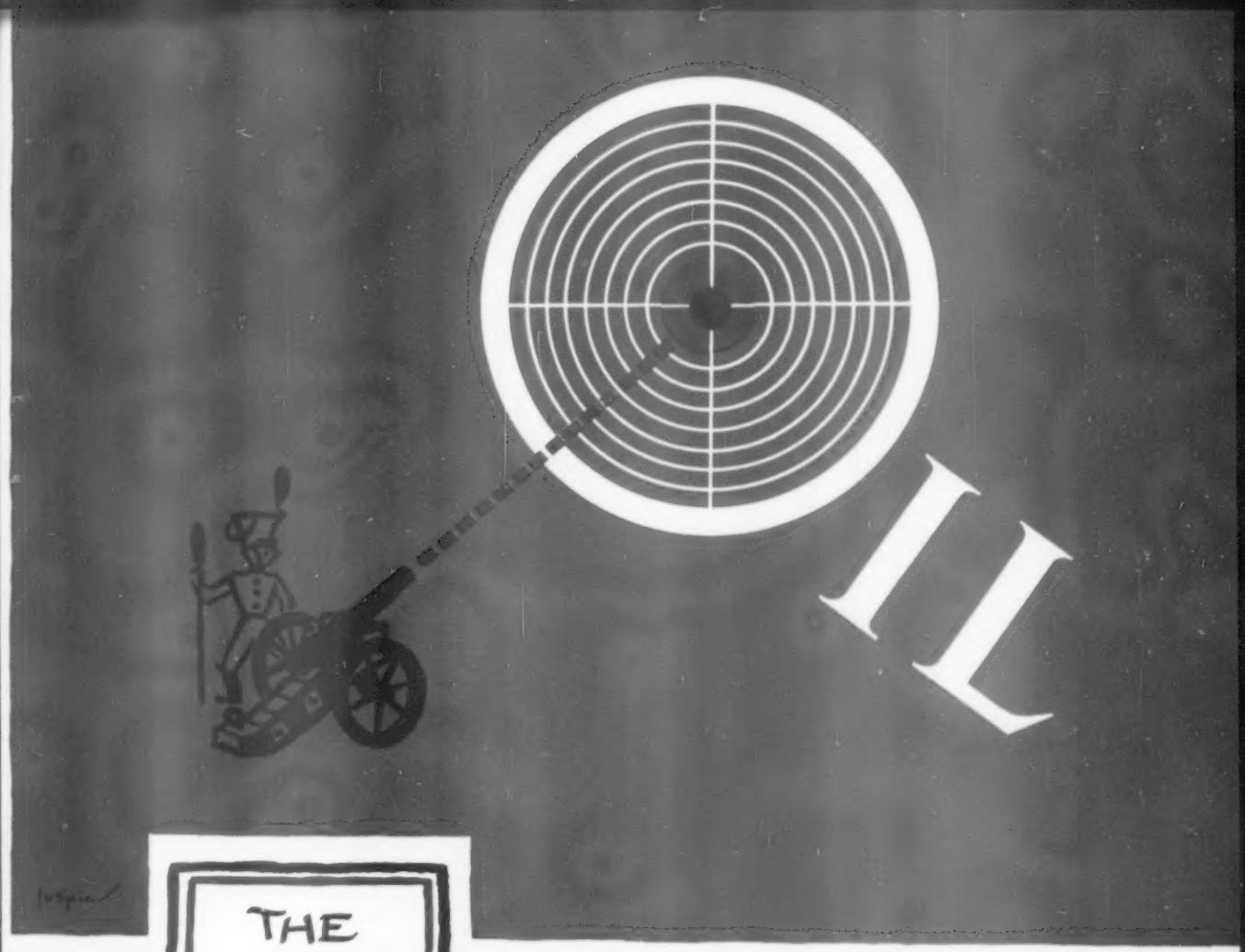
- the results of CARBIDE's 20 years' experience in the manufacture of amines and glycols.
- the service of CARBIDE's field representatives.
- the assistance of CARBIDE's laboratories where specialists devote a great amount of time to work on customer service problems.
- the benefit of CARBIDE's knowledge about the handling, properties, and use of these chemicals.
- the assurance of availability and fast service through CARBIDE's national distribution network of 50 warehouses. (In Canada: Harrisons & Crosfield's.) Shipments are made in tank cars, tank wagons, and drums in carload or truckload lots.

Remember.

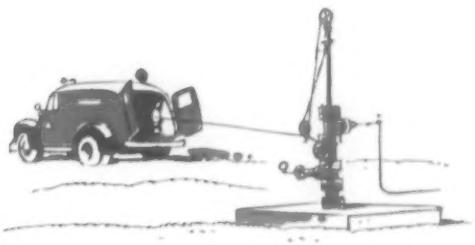
You get *more* than chemicals when you specify CARBIDE.

CARBIDE
AND CARBON
CHEMICALS

Carbide and Carbon Chemicals Company
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.



THE LITTLE GUN WITH THE BIG RESULTS



THE KEY TO PERMANENT WELL COMPLETIONS!

THE SCHLUMBERGER EXPENDABLE SHAPED CHARGE PERFORATOR PERMITS THE TUBING TO BE POSITIONED, WELL-HEAD EQUIPMENT INSTALLED, AND THE REMOVAL OF THE RIG ..... ALL BEFORE PERFORATING OPERATIONS ARE BEGUN ~

SCHLUMBERGER, FIRST IN THE FIELD, FOREMOST IN RESEARCH.

We're tipping our hat to line pipe men!

HERE'S A tip of our hat and a thank you to you line pipe men for the confidence you have shown in us.

In the past four years you've demonstrated your confidence in us by ordering more than 24,000 carloads of Basalt-Kaiser steel line pipe for major projects the country over. This is enough to build a pipe line from Juneau, Alaska to the Panama Canal.

It's good to know we've earned this confidence by delivering all of this steel line pipe *on time* . . . and by assuring you *uniform quality* and *prompt service*.

Kaiser Steel

KAISER STEEL PIPE SPECIFICATIONS • All pipe manufactured to latest A.S.T.M. and A.P.I. specifications

Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	14" to 18" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅛" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	20" to 30" O.D.	Up to 40'	.250" to .500"	Napa, Calif.—Basalt-Kaiser

Prompt, dependable delivery at competitive prices • KAISER STEEL CORPORATION Los Angeles, Oakland, Seattle, Portland, Phoenix, Denver, Tulsa, New York

IN SWAMP
— ON DRY LAND
— SMALL OR LARGE
INSTALLATION

PURCHASED

Electric Power

DOES IT

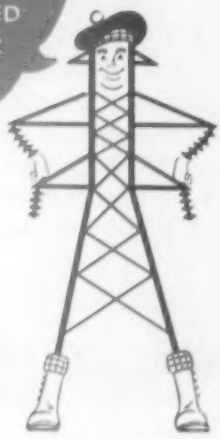
Cheaper

For economical, dependable, practically maintenance-free motive power the industry is relying more and more upon Purchased Electric Power. In literally thousands of installations . . . . in such diverse localities as these . . . . Purchased Electric Power furnishes dependable 24-hour-a-day service at LOWEST POSSIBLE COST!

Let Purchased Electric Power go to work for *you!* There's a Power Engineer at your nearest Electric Power Company who can give you the answer to all your power problems. Why not get in touch with him today?

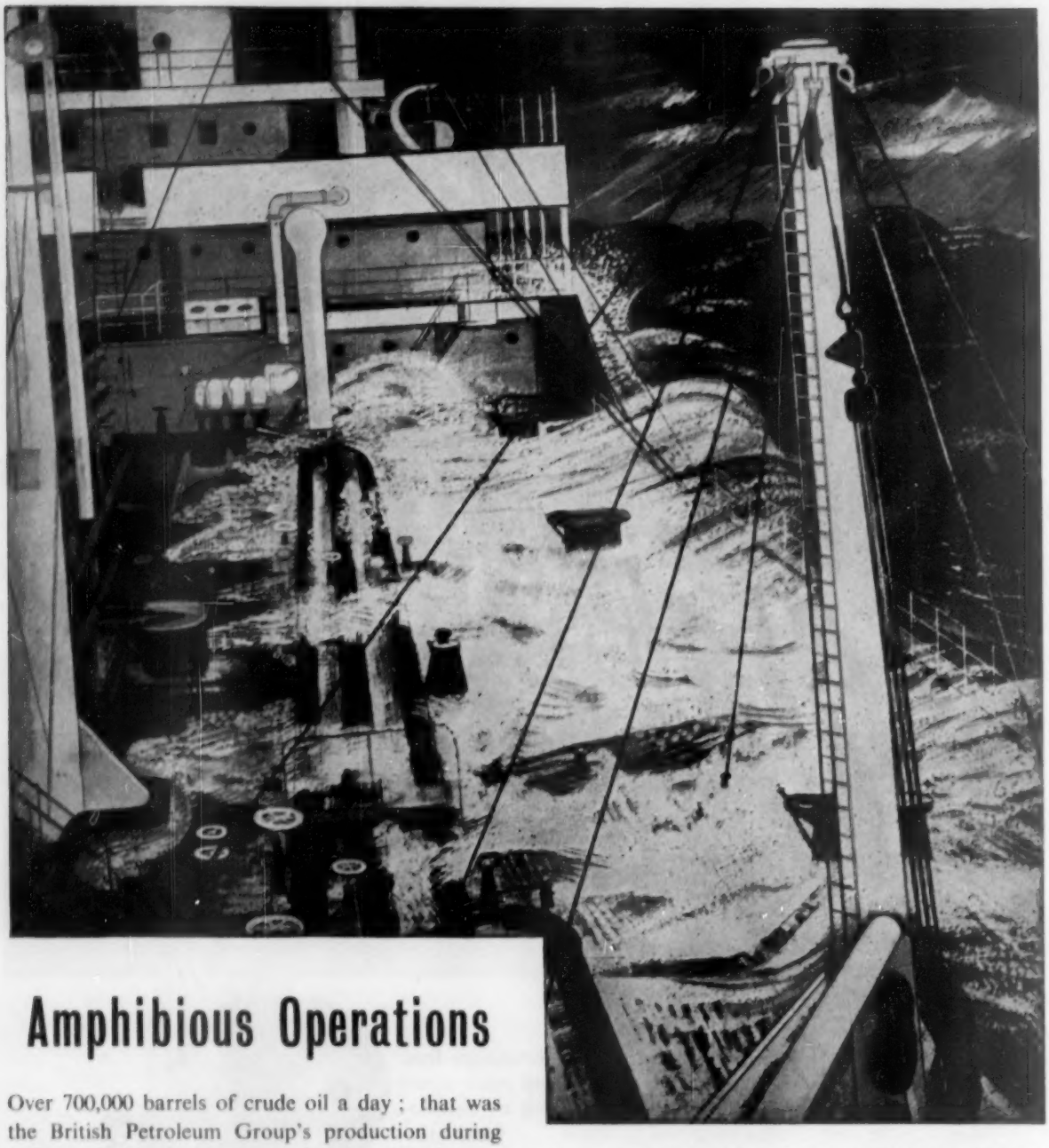
CALL YOUR NEAREST ELECTRIC SERVICE COMPANY for more facts, or address your request to P. O. Box 2771, Dallas, Texas

PRODUCE MORE IN '55 WITH PURCHASED ELECTRIC POWER!



Petroleum Electric Power association

ORGANIZED in the interest of greater service to the petroleum industry



Amphibious Operations

Over 700,000 barrels of crude oil a day ; that was the British Petroleum Group's production during 1954, and shipping it was a full-time job for the 7,000 officers and men of its shipping organisation, the British Tanker Company, one of the world's largest privately-owned fleets.

While ships of this fleet crossed and re-crossed the world, British Petroleum prospectors were searching for more oil in desert lands, tropical jungles and beneath the seabed itself.

A new refinery came on stream at Aden last summer to join the 12 others already operating in seven countries. A fourteenth, at Kwinana in Western Australia, is almost ready to go on stream.

THE BP SHIELD IS THE SYMBOL OF THE WORLD-WIDE ORGANISATION OF

The British Petroleum Company LIMITED

(Previously Anglo-Iranian Oil Company, Limited)

They Say—

Forecasts for '55

Eugene Holman, chairman of the board, Standard Oil Co. (N.J.).

"Although general business activity in the United States for 1954 will average 7 to 8 per cent below the 1953 level, prospects for the new year are bright. The outlook is for continued economic progress in the free world . . .

"Competition for the petroleum market became more intense (during 1954) than at any time since World War II . . . We look for competition to remain keen in 1955, rather than diminish.

"Capital expenditures in our industry and others are being made not alone to increase capacity, but also to improve quality, to reduce costs, and to develop new products. Capital and exploration expenditures of Jersey and affiliated companies in consolidation are now expected to total $785,000,000 in 1954. Of this, additions to property, plant, and equipment are estimated to amount to $625,000,000, while other expenditures made in the search for oil are expected to total $160,000,000.

"In 1955, those expenditures may be even greater . . ."

Robert G. Dunlop, president, Sun Oil Co.

". . . Domestic demand for petroleum in 1954 failed to increase the 4 per cent over 1953 as generally predicted a year ago. The increase was less than 2 per cent in 1954 over 1953. However, this set an all-time record for United States consumption of petroleum products.

"It is probable that domestic demand in 1955 will continue to grow, possibly by about 3 per cent over 1954 . . .

"Drilling activity, upon which the country's future oil supply depends, was carried to a new all-time high of 53,000 wells in 1954. No slackening of this drilling effort is indicated in 1954 . . ."

Gen. Ernest O. Thompson, chairman, Texas Railroad Commission.

"It looks like 1955 is going to be a prosperous year for oil men if caution is shown in all departments.

"It is sincerely hoped that importers will show restraint and not flood the market with oil. No one objects to reasonable imports. We just ask that restraint be shown. I believe the American people will sustain this reasonable request . . .

"The anticipated increase in demand

Always the same high standard of quality
NO-GALL
50% PURE METALLIC ZINC BASE
LO-TORK
50% METALLIC LEAD BASE
WECO
LO-TORK
COMPOUND
• It's wise to standardize with these WECO Compounds for tool joints and drill collars. Every gallon of these WECO Compounds has the same unvarying high quality – the same dependable assurance of proper thread lubrication and protection for string after string of drill pipe and drill collars.
Immediate availability, today and tomorrow, is another important reason why it's wise to standardize with WECO Compounds. Wherever you are – whenever you need them, you can always count on getting WECO NO-GALL and LO-TORK to protect tool joint and drill collar threads.
PESA
It's wise to standardize with... WECO
WECO
WELL EQUIPMENT MFG. CORP. • Division of Chiksan Company • HOUSTON 1, TEXAS

"It's the little things that count"
in giving you greater service life

Where Mission makes the difference

Nothing but the finest will ever bear the name of

Right here is where Mission Piston Rods get their Satin Finish* for longer life. And it's another example of the extra care Mission takes to build only equipment that out-performs any other equipment in competitive tests.

Designed by Mission engineers, this machine which applies the exclusive Mission Satin Finish* is the only machine of its kind in existence. As Mission Piston Rods move through the machine on an endless conveyor, they are given a vapor honing that adds an ultra smooth surface to the entire rod, threads and wearing surface. This exclusive Mission satin smooth taper guarantees better rod and piston fit and less chance of washout. The Satin Finish* on the threads also prevents galling.

Mission builds two outstanding piston rods: The Mission File-Hard Satin Finish* Piston Rod and Mission Super-Chrome Piston Rods. Whichever one you select for your pumps, you can be sure that you will receive the longest rod life obtainable. Specify Mission to your supply store.

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*Trade Mark, Registered U.S. Patent Office.

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Export Office: 30 Rockefeller Plaza, New York

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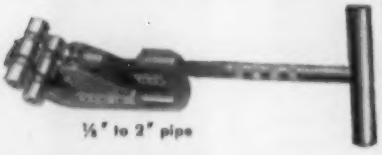
PIPE WRENCH

- ★ Unconditionally Guaranteed
- ★ Single Spring—gives quicker, easier setting
- ★ Replaceable Jaws
- ★ Improved Hand-Grip
- ★ Sizes 6" to 48"

Order from your supplier today.

Need a Good Pipe Cutter?



⅛" to 2" pipe

Try the new TOLEDO No. 20 with 6 rollers—recommended for use with power drives—works fine by hand, too.

THE TOLEDO PIPE THREADING MACHINE CO. • Toledo 4, Ohio

"TOLEDO"

Builders of the World's Finest Pipe Tools

Pipe Threaders
Pipe Wrenches
Power Pipe Machines

(3 to 5 per cent according to the Texas Railroad Commission) . . . is hardly adequate to care for the expected increase in the abilty to supply (15 to 20 per cent according to the Railroad Commission). Consequently, if Texas is to maintain its present niche in the producing picture, we are going to have to receive a share of the national demand more in keeping with the Texas percentage of the nation's reserves . . ."

It's Just How You Look at It

Dear Sir:

The fifth paragraph, third column, page 76, Journal for January 3, mentions a National T-32 rig. It's shown in the picture at the upper left. That's a Lee C. Moore trailer mast, son.

Also first paragraph, first column, page 77, same issue, mentions a National 100. This is also a Lee C. Moore Cantilever with this rig.

H. J. Woolslayer
Vice President
Lee C. Moore Corp.
Tulsa.

(Editor's Note: The news story cited by reader Woolslayer did not lend itself to a further description of the rigs in question. However, he brings up an interesting point—that rigs are viewed differently by various segments of the industry. Normally, Journal editors classify rigs by the drawworks since this is a limiting factor as to how deep a rig can drill. However, there often are cases where a more detailed description is necessary. In these cases, we try to be more specific, and certainly a "rig" to a drilling contractor as well as to a derrick manufacturer means the "whole works.")

Adds Dignity to Journal

Dear Sir:

I am writing you my candid opinion of the "new look" cover of The Oil and Gas Journal. . . . It is a decided improvement over your old plan of having an advertisement on the cover and is indeed in keeping with the high quality of "The Big Yellow Book." I realize that this will curtail, in a small amount, your income, but I sincerely believe it adds dignity to the publication.

Best personal regards.

John L. Terrell
Director of Public Relations
Magnolia Petroleum Co.
Dallas

Building Has New Name

Dear Sir:

On page 178 of the December 27, 1954, issue of the Journal, British

PUMPING PROBLEM

REDA

MAY HAVE THE *RIGHT* ANSWER

. . . from ⅓ HP to 240 HP . . . from 20 bbls to 17,000 bbls . . . from 200' to 10,000' and more . . . Yes, a REDA may do that pumping job BETTER . . .

Reda Pumps are accepted as original equipment, or replacement equipment, because they produce at a lower cost per barrel of fluid. Whether it's large volumes from shallow depths, or modest volumes from great depths, Reda Pumps provide operating savings.

IMPROVED DESIGN:

Constant research and design improvement are responsible for lengthened operating life; corrosion resistance, low labor cost per barrel of fluid produced.

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Greatly improved overall efficiencies have improved Reda performance as much as 25%; a substantial operating saving.

If you have a pumping problem, our engineering staff is always ready to assist you. Phone or write:

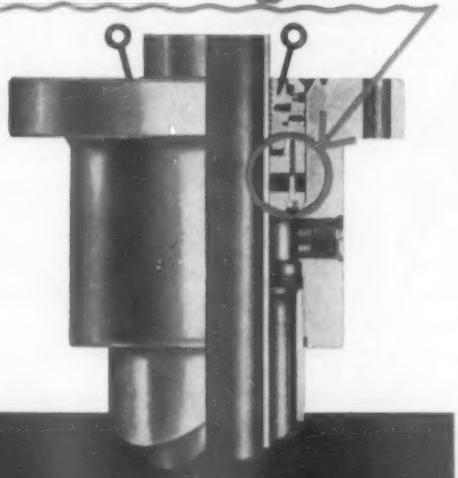
REDA

PUMP COMPANY

BARTLESVILLE, OKLAHOMA

It's human nature to forget sometimes...

but this O-C-T AUTOMATIC SEAL *Can't Forget*



Regardless of how or when you decide to install the O-C-T "C-20" Casing Hanger . . . before cementing, after cementing, through preventers, under preventers, or at any time in case of stuck pipe . . . you can improve the safety of your completion operations and save hours of expensive rig time due to the flexible, simplified O-C-T installation procedure.

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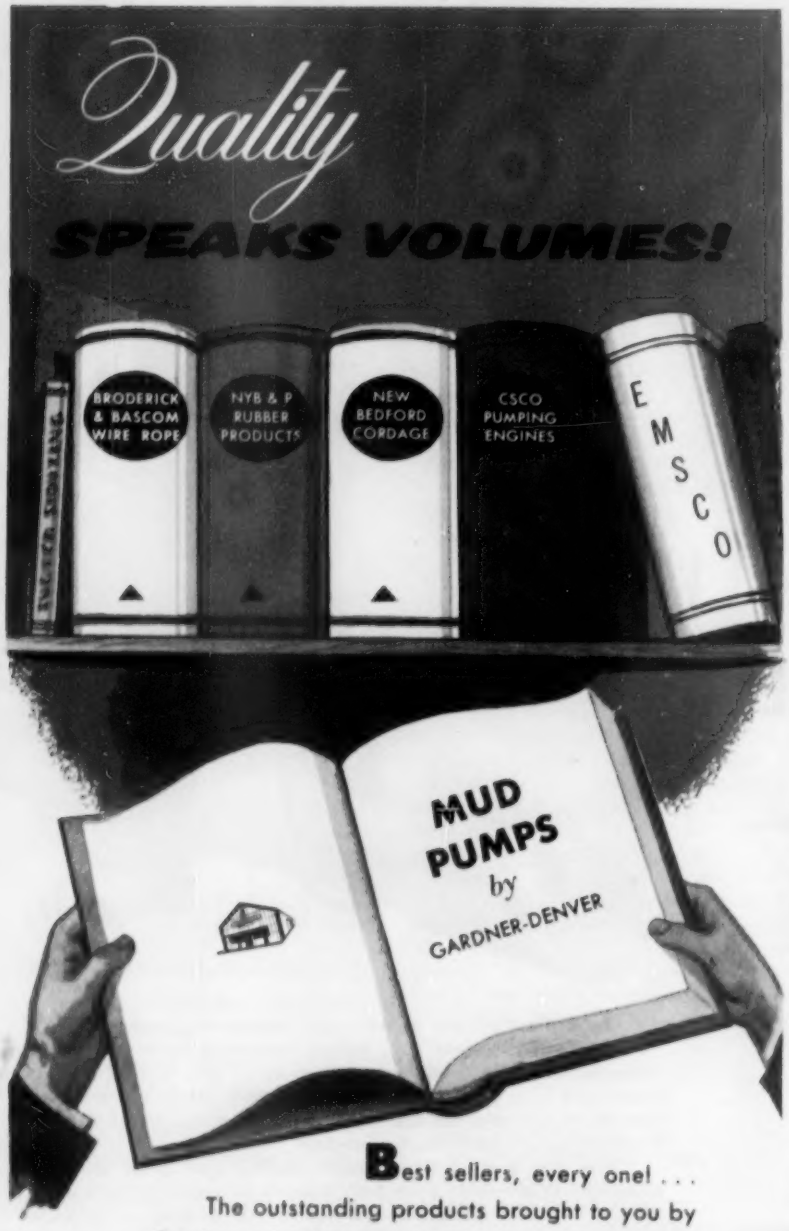
with O-C-T C-20 CASING HEADS

Oil Center Tool *Co.*

P. O. Box 3091
Houston, Texas

Export Representatives: Sterling Areas—La Grand, Sutcliff & Gell, Ltd., Rochester, Kent, England. South America—East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.



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THE CONTINENTAL SUPPLY COMPANY
General Offices: DALLAS, TEXAS
Representatives in All Principal Oil Fields of the World

American Oil Co., Ltd.'s address has been given as Royal Bank Building.

It is now British American Oil Building, 800 Bay Street, Toronto . . .

H. D. Ringland
Manager, Publications Division
Public Relations Department
British American Oil Co., Ltd.

Likes Our Exploration News

Dear Sir:

We have really enjoyed reading the Journal's articles on the various "hot" areas of exploration, and are amazed at how timely they are. . . .

The recent article on the "Hottest in the Nation," December 6, 1954, may be correct in illustrating the Springer wedge-edge as it did. However, I think the diagram would have been more nearly right if the Deese sands had been onlapping the Mid-Dornick Hills unconformity. I could be wrong.

Robert Greider
The California Co.
Jackson, Miss.

When Demand Will Top Supply

"Without entering the discussion of how long oil is going to last, I shall simply summarize views of others which indicate that along about 1970 oil and gas may begin to be unable to meet the demand for fluid fuels. If this happens, the use of coal will increase rapidly as a source of gasoline and gas, since we shall be reluctant to give up automobiles and gas heat. All the while, total energy consumption will be mounting, increasing nearly fivefold between 1950 and 2,000 . . ."

Dr. Lawrence R. Hafstad, director, division of reactor development, Atomic Energy Commission, in an address in St. Louis before the Electric Companies Public Information Program Annual Workshop Conference.

CALENDAR

1955

JANUARY

26-28 Symposium on instrumentation for process industries, A. & M. College of Texas, College Station, Tex.

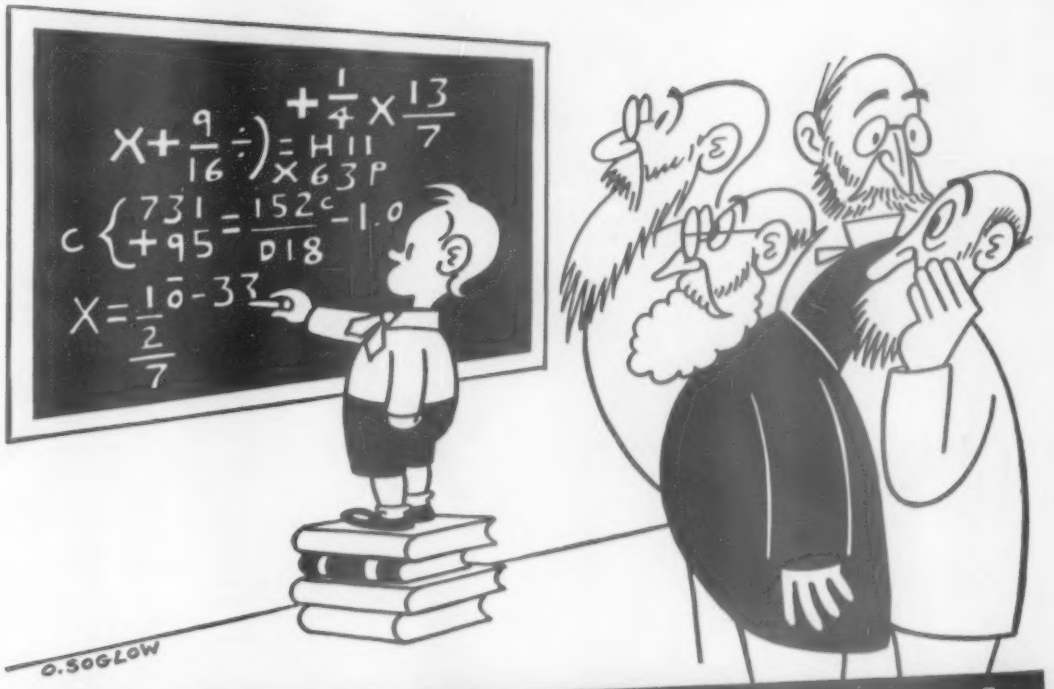
27-28 American Chemical Society, symposium on hydrocarbon chemistry, Rice Hotel, Houston.

27-28 Southern California Meter Association, fourth annual instrument short course, Los Angeles Harbor Junior College, Wilmington, Calif.

31-Feb. 2 Sixth annual Southeastern Symposium on Industrial Instrumentation, University of Florida campus, Gainesville, Fla.

FEBRUARY

10-12 Seventh Southwestern IRE Conference



You'll be surprised at these figures!

Thanks to the thrift of employed Americans and the cooperation of 45,000 companies which have enrolled more than 8,000,000 men and women in the Payroll Savings Plan—

- Sales of E and H Bonds (H Bond is the current-income companion piece of the E Bond, sold only to individuals and purchased in larger denominations by executives) in 1954 totaled $4.9 billion, a new peacetime record.

- Sales in 1954 exceeded *all redemptions* in that year of matured E Bonds and unmatured E and H Bonds by more than $400 million—the highest net amount since 1949.

- Cash value of E and H Bonds outstanding reached a new record high of $38.2 billion, a gain of $1.5 billion in 1954.

- This $38.2 billion cash holding by individuals represents 14% of the national debt. Never before has the national debt of our country been so widely held.

These figures, far more effectively than mere words, tell the story of The Payroll Savings Plan—why it is good for America, why it is good for business. If you do not have the Plan, or if you have the Plan and your employee percentage is less than 50%, phone, wire or write to Savings Bond Division, U. S. Treasury Department, Washington, D. C.

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THE OIL AND GAS JOURNAL

TULSA 1, OKLAHOMA

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- REDUCERS
- HALF COUPLINGS

And be 3 Ways SURE

...THAT THE MATERIAL IS RIGHT—all W-S steel couplings and reducers are in accordance with ASTM Specification A-105—Grade 2.

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...THAT THE IDENTIFICATION IS RIGHT—recessed figures on outside circumference clearly define the pressure rating and the material — and the unmistakable Double-Diamond trade mark is your assurance of high quality manufacture.

Watson-Stillman Couplings and Reducers in your piping system mean true economy. They give you long, trouble-free service, insure strong, leakproof joints and readily withstand the effects of shock and vibration.

Strengthen your piping system with these Watson-Stillman fittings. Screw-End Type available in 3,000 and 6,000 lb. class, sizes ⅛" to 6". Socket-Welding Fittings for schedule 40, 80, 160 and Double-Extra Heavy pipe in sizes ⅛" to 6".

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13-17 American Institute of Mining and Metallurgical Engineers, annual meeting, Conrad Hilton Hotel, Chicago.

13-18 A.S.T.M. Committee D-2 on Petroleum Products and Lubricants, Rice Hotel, Houston.

14-16 Rocky Mountain section of A.A.P.G., annual regional convention, Billings, Mont.

16-18 National Association of Corrosion Engineers, sixth annual short course for pipeliners, Mayo Hotel, Tulsa.

23-24 Pacific Coast Gas Association, seminar on electronic data processing, Los Angeles.

25 National Gasoline Association of America, Permian basin regional meeting, Scharbauer Hotel, Midland, Tex.

MARCH

1-2 American Gas Association committee on natural gas reserves, Baker Hotel, Dallas.

4 Southern Gas Association, transmission management conference, Shamrock Hotel, Houston.

7-11 National Association of Corrosion Engineers, Palmer House, Chicago.

9-11 American Petroleum Institute, Division of Production, Southwestern spring meeting, Jung Hotel, New Orleans.

17-18 Southern Gas Association, Distribution Management Conference, Jung Hotel, New Orleans.

20-23 American Institute of Chemical Engineers, Kentucky Hotel, Louisville.

23-24 Pacific Coast Gas Association, accident prevention conference, Santa Barbara, Calif.

23-25 American Petroleum Institute, Division of Production, Mid-Continent District, Herring Hotel, Amarillo, Tex.

27-29 Texas Independent Producers and Royalty Owners Association, ninth annual meeting, Hotel Texas, Fort Worth.

28-31 American Association of Petroleum Geologists, Society of Exploration Geophysicists, and Society of Exploration Paleontologists and Mineralogists, annual meeting, Hotel Statler, New York.

28-April 1 American Society for Metals, 9th western exposition and congress, Pan American Auditorium, Los Angeles.

APRIL

5-7 Corrosion control short course, sponsored by University of Oklahoma and Central Oklahoma Section of National Association of Corrosion Engineers, University of Oklahoma Extension Study Center, Norman, Okla.

7-8 Rocky Mountain District, American Petroleum Institute, Division of Production, Gladstone Hotel, Casper, Wyo.

13-15 Natural Gasoline Association of America, annual convention, Baker and Adolphus hotels, Dallas.

13-15 American Society of Lubrication Engineers, tenth annual meeting, Hotel Sherman, Chicago.

13-15 National Petroleum Association, 52nd semiannual meeting, Cleveland Hotel, Cleveland.

18-20 American Society of Mechanical Engineers, spring meeting, Lord Baltimore Hotel, Baltimore.

19-20 Pacific Coast Gas Association, distribution conference, Phoenix.

19-21 Southwestern Gas Measurement Short Course, North Campus, University of Oklahoma, Norman, Okla.

20-22 Petroleum Industry Electrical Asso-

Magcobar means more
than mud alone ... it means ...

Looking ahead

It is not simply by luck or accident that your Magcobar dealer has what you need when you need it. He has carefully planned it that way. He knows . . . because he has spent long hours learning . . . the needs of operators in his area. He has looked ahead to satisfy your needs. Since Magcobar first introduced high quality drilling fluid additives . . . since Magcobar first introduced fair and reasonable mud prices . . . Magcobar has looked ahead by providing for the operator's present and his future needs. Let the Magcobar engineer be a partner on your next well.

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ONE OF THE DRESSER INDUSTRIES
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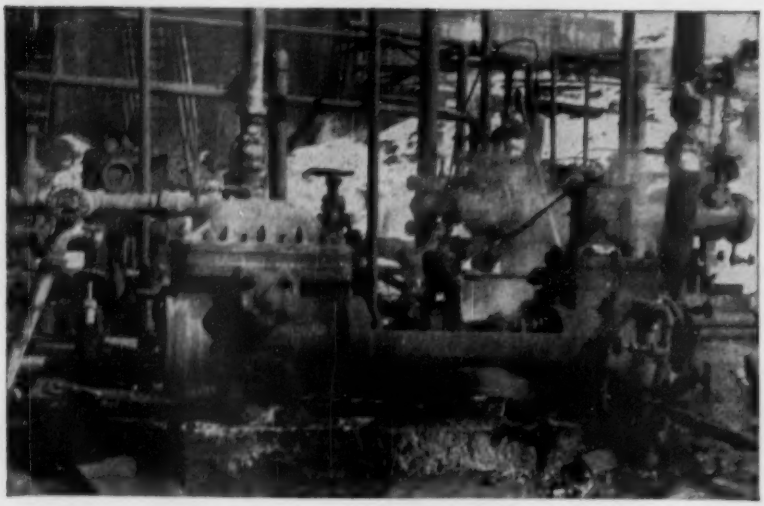


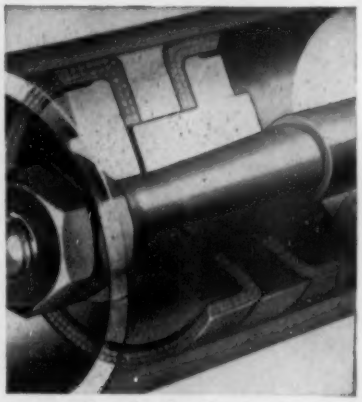
"CHAMBER OF HORRORS"

—for anything but a DARCOVA PUMCUP!

"HOW tough can life get", says ordinary packing inside this pump. Yet, year after year this pump is required to handle acid treated oil products from the base of a heated still to the next purifying process.

Ordinary packing would soon allow slippage to occur—but not Darcova Pumcups. Pumcups retain their efficiency even when severely worn. This installation has operated efficiently for over eight years.

No matter how tough your pumping problem may be, you can do it more efficiently and for lower cost with Darcova Pumcups!



Cross section showing Pumcup installed.

Write for free bulletin No. 4401 on how Pumcups can help solve your pumping problems!

DARCOVA
THE ORIGINAL COMPOSITION CUP

DARLING VALVE & MANUFACTURING CO.
WILLIAMSPORT 1, PA.

PUMCUPS

cation, annual conference, Shamrock Hotel, Houston.

25-26 Independent Petroleum Association of America, midyear meeting, San Antonio.

28-29 American Petroleum Institute, Division of Production, spring meeting of Pacific Coast district, Statler Hotel, Los Angeles.

MAY

1-4 Liquefied Petroleum Gas Association, annual convention, Conrad Hilton Hotel, Chicago.

1-4 American Institute of Chemical Engineers, Shamrock Hotel, Houston.

9-10 American Gas Association, Gas Supply, Transmission and Storage Conference, Hotel William Penn, Pittsburgh.

9-12 American Petroleum Institute, Division of Refining, midyear meeting, Jefferson Hotel, St. Louis.

11-12 Pacific Coast Gas Association, gas supply and transmission and conference of technical session, Palm Springs, Calif.

11-13 American Petroleum Institute, Division of Production, Eastern District spring meeting, William Penn Hotel, Pittsburgh.

12-19 Sixth Latin American Congress of Chemistry, Caracas, Venezuela.

14-22 World Wide Chemical Plant and Equipment Exposition and Congress, Frankfurt Germany.

16-18 American Petroleum Institute, Division of Transportation, products pipeline conference, Edgewater Beach Hotel, Chicago.

16-18 Southern Gas Association, New Orleans.

23-25 American Petroleum Institute, Division of Marketing, midyear meeting, Chase and Park Plaza hotels, St. Louis.

26-27 Kentucky Oil and Gas Association, annual meeting, Lafayette Hotel, Lexington.

30-June 1 Chemical Institute of Canada, thirty-eighth annual conference and exhibition, Quebec City, Que.

JUNE

5-9 Canadian Gas Association, annual meeting, Sheraton-Brock Hotel, Niagara Falls, Ont.

6-10 American Petroleum Institute, Division of Production, midyear committee conference, Brown Palace Hotel, Denver.

6-15 Fourth World Petroleum Congress, Rome, Italy.

9-10 Natural Gas and Petroleum Association of Canada, Royal Connaught Hotel, Hamilton, Ont.

9-10 Pennsylvania Grade Crude Oil Association, annual meeting, Hotel William Penn, Pittsburgh.

11-15 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alberta, Canada.

12-17 Society of Automotive Engineers, golden anniversary summer meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

16-18 Interstate Oil Compact Commission, Denver.

20-23 American Society of Mechanical Engineers, semiannual meeting, Statler Hotel, Boston.

28-July 1 American Society for Testing Materials, Chalfonte-Hadden Hall, Atlantic City, N. J.

AUGUST

15-17 Society of Automotive Engineers, golden anniversary West Coast meeting, Hotel Multnomah, Portland, Ore.

Levingston

WORLD HEADQUARTERS FOR FINE MARINE PETROLEUM EQUIPMENT

LEVINGSTON SHIPBUILDING COMPANY • ORANGE TEXAS

SMALL IN SIZE... BIG IN PERFORMANCE

AMERICAN IRON

UNIVERSAL FRICTION CATHEADS

MAKEUP AND BREAKOUT

For use on ANY SIZE drawworks . . . the "Universal" is small in size but BIG in performance. Easily installed on small drawworks but rugged enough for the largest drawworks.

Check these Features:

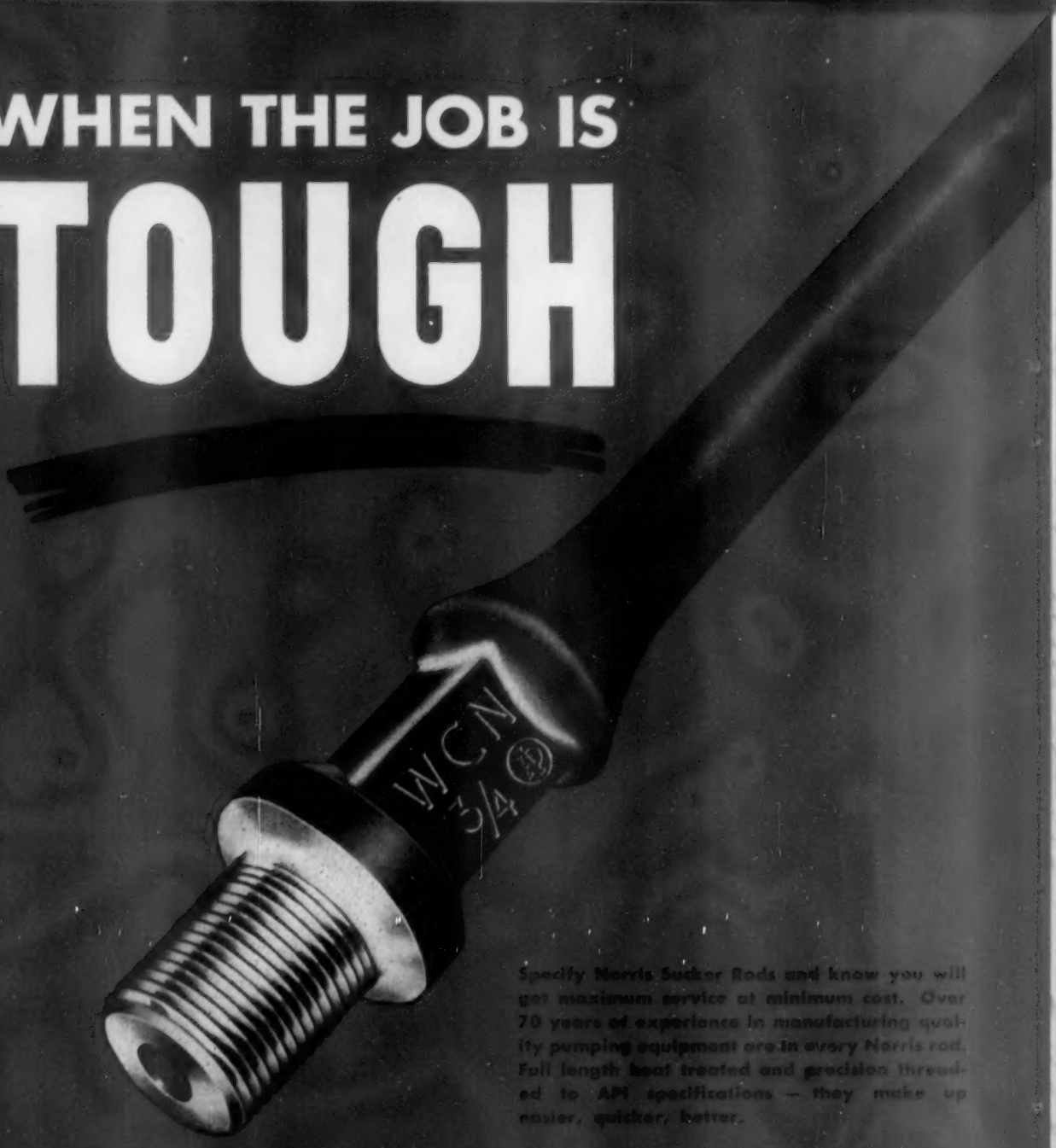
- Power enough to break any connection!
- Line pull closer to shaft bearing!
- Instantaneous engagement and release!
- No sensitive toggles to get out of adjustment!
- Rope divider mounted to safety guard — requires no welding to drawworks!
- Available with air or manual controls!

AMERICAN IRON & MACHINE WORKS CO. A OKLAHOMA CITY U.S.A.

PEGA

To get the *best results* on any drawworks, specify American Iron Universal Friction makeup and breakout catheads!

WHEN THE JOB IS TOUGH



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THE OIL AND GAS
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TULSA, OKLAHOMA

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Member
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JOURNALLY Speaking

Teaser

NEXT week there'll be another change in our favorite oil publication.

Brace yourself: The Table of Contents is going to be moved off of the first page.

"What!", you say. "Take a backward step? Make us go back to the game of hide-and-seek to find the index? No, no! Keep it up in front where it belongs."

Keep your shirt on. The table of contents will stay "up in front where it belongs." But it will be spread across pages 2 and 3 instead of being jam-packed into page 1.

The new format will give us some elbow room. We'll have space to identify the articles and features better, give authors' names, and include brief summaries of some of the more important articles.

So what are we going to do with page 1? That's a secret. You'll have to wait until next week and see for yourself.

But we'll tell you this much: Page 1 will be given over to a brand-new editorial feature. It's something we've been tuning up for quite a while, and we finally have it on the beam. It makes its bow next week. Watch for it.

Only Good News

SPEAKING of changes in the Big Yellow Book, we made another one a couple of weeks ago. We stopped printing a routine list of unsuccessful wildcats back in the exploration section.

Part of the reason was to provide more space for listing and discussing the successful wildcats. With something like a thousand wells being completed every week, and a couple of hundred of them wildcats, it takes a lot of space just to list the discoveries. Of course we discontinued listing field wells years ago.

Another factor was the conviction of our exploration editors that many routine dry holes are of little importance to anyone except those who drill them. But a discovery is important to a great many people besides the successful wildcatter. Holders of nearby leases step up their own exploration programs immediately. Geologists and geophysicists revise or confirm their data. Drillers prepare to move in for development work. Pipeliners make plans to pick up the oil. Refiners start studying the characteristics of the crude. Equipment salesmen reach for the 'phone. It's successful wildcats that keep the industry moving.

Our new policy isn't just a Pollyanna attitude of printing only good news and ignoring everything unpleasant. It's a matter of the best use of our time and space for the greatest service to the largest number of readers.

We continue to keep careful count of all wells drilled—field or wildcat, dry or successful—for statistical purposes. We give the tabulation every week, a summary every month, and an annual recapitulation every year. And whenever a prominent dry wildcat is important from a geological or other standpoint, its significance is discussed for a few paragraphs under the appropriate geographical category of our exploration section.

Unwild Wildcats

AND speaking of wildcats, what is a wildcat? That's something the industry has never been able to agree on. Practices differ among states and even among operators in the same field.

In general, we follow the terminology of the local scout reports, and classify wells the way the operators designate them. But often we use our own editorial judgment and reclassify wells to conform to general industry practice in most areas. For instance, a two-location stepout from established production might be called a field well by us even though the operators claimed a discovery. That's why our breakdown of total completions between wildcat and field wells sometimes differs from others' listings.

Henry D. Ralph

FILL YOUR CASING AUTOMATICALLY

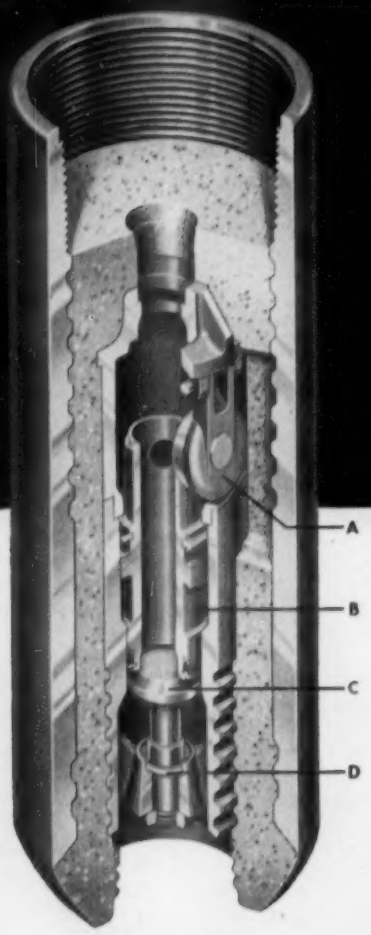
...from the bottom...while it's being run

with BAKER

• DIFFERENTIAL FILL-UP SHOES *and*
• DIFFERENTIAL FILL-UP COLLARS

Here's what DIFFERENTIAL FILL-UP Equipment does . . .

Permits the casing to *fill automatically from the bottom*, while it is being run, to within 90% of the fluid level of the annulus (using a shoe OR a collar)—or to within 81% of the fluid level of the annulus (using *both* a shoe AND a collar). In addition, a back-pressure valve is present to be used at the *discretion of the operator*, for "floating" or for cementing.



Baker DIFFERENTIAL FILL-UP Shoe, Product No. 1081.

A—Flapper Valve functions only at discretion of operator.
B—Sleeve Valve operates to control rate of flow and volume of "fill-up" fluid.
C—Sleeve Valve Seat.
D—Shear Ring is sheared. Flapper Valve now functions for floating or cementing.

Here's how Baker DIFFERENTIAL FILL-UP Equipment will aid you to avoid danger, increase rig efficiency, save valuable time and promote safety...

REDUCES THE DANGEROUS "RAM EFFECT" thus minimizing the hazard of breaking down a potential lost circulation zone.

SAVES COSTLY DRILLING MUD that might otherwise be lost to the formation due to the "ram effect."

MINIMIZES DAMAGE TO MUD CAKE on the wall of the hole. The majority of the fluid displaced as the casing string is lowered enters the casing instead of flowing up the annulus and causing possible damage to the mud cake.

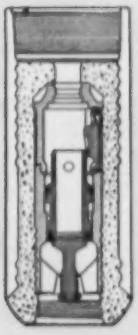
REDUCES DANGER OF STICKING CASING by reducing to a minimum the "no-motion time" formerly required to fill casing at the surface—extremely important when running casing in directional holes or sloughing formations.

SAVES ONE-HALF THE RUNNING-IN TIME plus the proven advantages of Baker Floating Equipment, including a back-pressure valve for cementing.

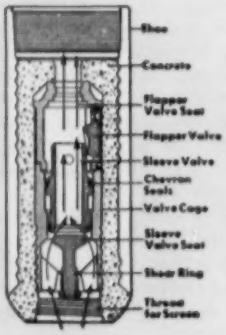
KEEPS THE RIG FLOOR CLEAN AND SAFE by eliminating the messy spill-over and splattering of mud present when casing is filled at the surface.

Ask any Baker representative or office for this new 16-page illustrated brochure . . .

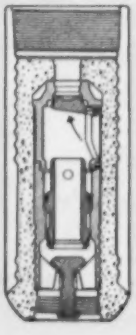
BAKER OIL TOOLS, INC., HOUSTON · LOS ANGELES · NEW YORK



When running-in, the Sleeve Valve is in closed position in contact with the Sleeve Valve Seat. When the Sleeve Valve is in this position, fluid entry into the casing from below the valve is effectively blocked. The Sleeve Valve will be in the closed position whenever the height of the fluid column in the casing (the fill) EXCEEDS 90% of the height of the fluid column in the annulus.



When the height of the fluid column in the casing (the fill) is LESS than 90% of the height of the fluid column in the annulus, the Sleeve Valve moves upward away from the Seat and permits fluid entry into the casing through the bottom of the FILL-UP Shoe. During the casing run, the Sleeve Valve opens and closes according to the pressures imposed on its top and bottom areas and thus automatically regulates the degree of fill.



When it is time for cementing, pressure of approximately 1,000 psi is built up in the casing to shear the Shear Ring that holds the Sleeve Valve Seat in the supporting vanes of the Valve Cage. The Sleeve Valve can then move downward sufficiently to release the spring-loaded Flapper Valve, and thereafter the FILL-UP Shoe functions as a conventional Float Shoe.

Will lower prices stop crude imports?

REMEMBER Samson? In blind revenge he pulled down the pillars of the temple on himself and all the rest.

The southwestern oil states are in danger of emulating Samson.

A fast-spreading attitude among producers in this region is that the way to deal with imports is to flood the market with oil and let the price fall where it may. If the regulatory bodies of these states continue to reflect this attitude, as they did in setting January allowables, the pillars of the entire petroleum industry's financial structure will soon crumble.

Oil was brought from a fly-by-night, speculative venture to a stable, bankable industry by proration, which kept supply in approximate balance with demand and prevented feast-and-famine fluctuations in prices.

ONE PILLAR OF THIS STRUCTURE has been undermined by the growing volume of unprorated oil, chiefly from abroad. Proration won't work unless it covers a fairly large portion of the total supply. Its base—those states which have held firm up to now—has become so narrowed that the price structure already is showing cracks. Importers could rectify this if they would.

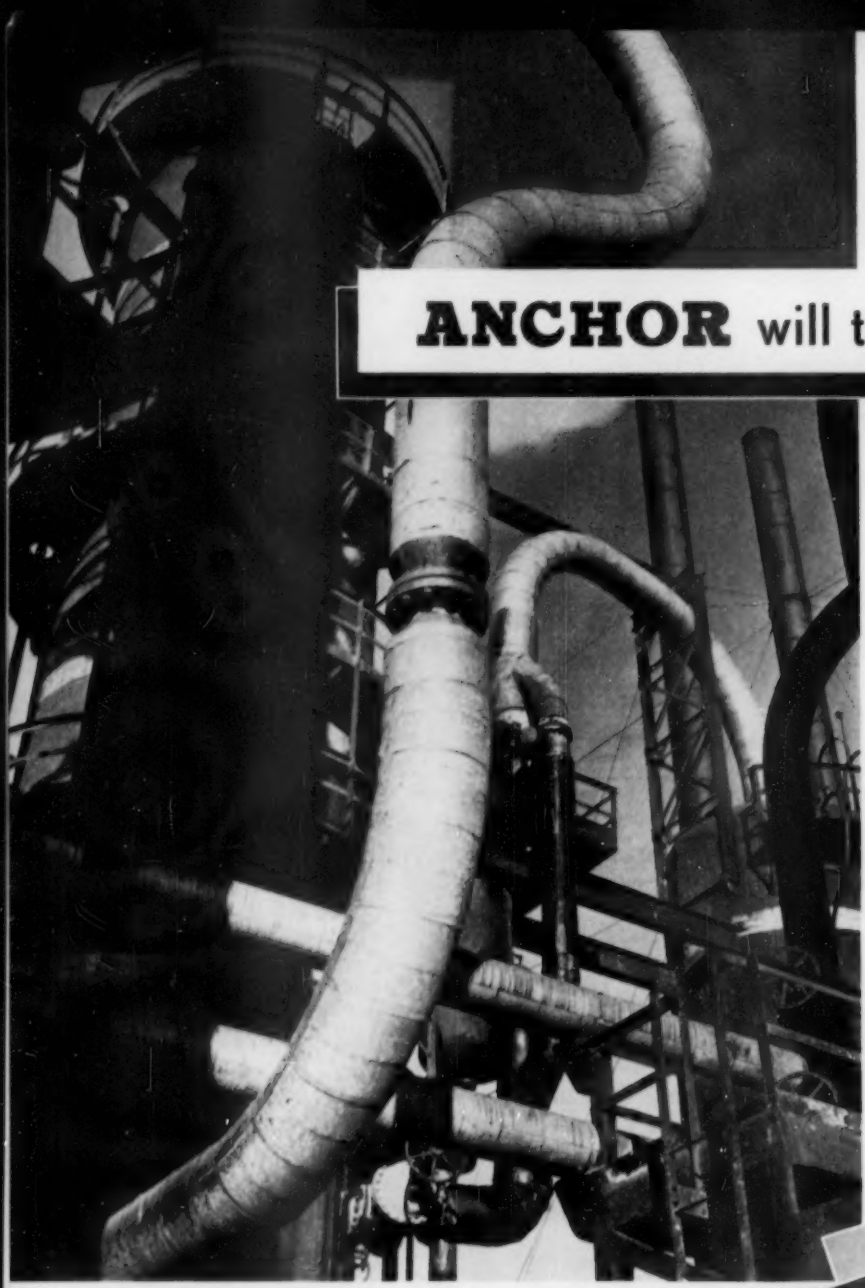
But are domestic producers justified in giving the coup de grace to the tottering petroleum edifice, no matter how righteous their wrath and desperate their plight? Undoubtedly the southwestern states have the power to break the price of crude if they choose to ignore market demand. But are they miscalculating the risk? Are the stakes worth the gamble?

Many of them think they can undersell foreign oil and that a price cut will automatically shut off much of the imports. If this is so, a price cut will be the simplest solution to the imports problem. But that's a long-shot gamble in view of the rising exploration and operating costs here and the vast reserves abroad.

Others think that falling crude prices will quickly induce Congress to impose restrictions on imports. This also is far from a sure bet in view of the pressures that can be brought against such legislation.

THE RISK OF STILL MORE OVERSUPPLY is a drop in crude prices which will slash the values of all underground reserves, shrink the collateral on which production is financed, force bank loans to be called, and tumble security quotations. Consumption will not be increased, and it will take a long, long time to work prices up again.

This threat to pull down the last remaining pillar of the financial structure could be only a bluff. But the producers, blinded with rage, may carry it too far and pull the house down on themselves, like Samson.



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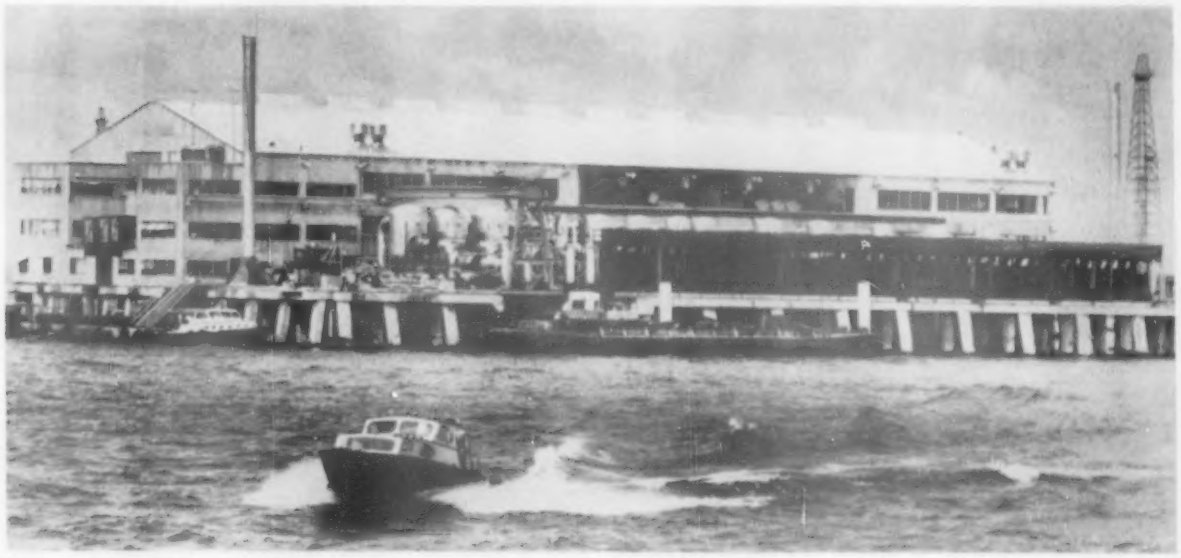
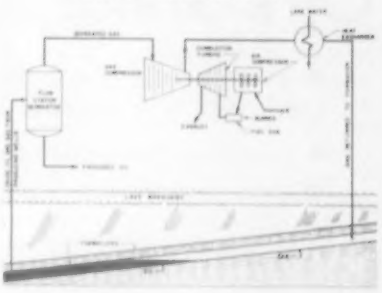
THIS WEEK . . . . . IN THE NEWS



THIS GAS-INJECTION PLANT goes into full operation this week 7 miles offshore in Lake Maracaibo, Venezuela. One of the largest in the world, the plant was dedicated by Creole Petroleum Corp. January 15. Attending the dedication ceremonies were P. C. Lauinger, president and publisher of The Oil and Gas Journal, and Dr. Oscar B. Irizarry, publisher-editor of Petroleo Interamericano, the Journal's Latin American affiliate. The plant is expected to increase production by 50 per cent at once, and increase ultimate production by 33 per cent. The installation rests on concrete piling 80 ft. above the lake bed and was built at a cost of $20 million. A detailed engineering description of this pressure-maintenance plant appears in this issue of the Journal on pages 98-99.

A SCHEMATIC DIAGRAM
OF
PRESSURE MAINTENANCE PLANT



AMMONIA—The oil industry's headlong plunge into synthetic anhydrous ammonia will be tempered with caution in the future, but the industry will continue to increase its stake in this chemical field. . . . The swing toward more petroleum-derived hydrogen for ammonia production will continue for the next 10 to 12 years. . . . The danger signals for the industry generally are in the impending oversupply period which the boom in ammonia-plant building is bringing. . . . Natural gas will continue to dominate the source field for ammonia production for several years. . . . Reformer hydrogen is going to enter the picture, but just how much is still a question because of geographical factors involved. . . . Unless gas prices level off, hydrogen from partial oxidation of heavy residual will become a major factor. . . .

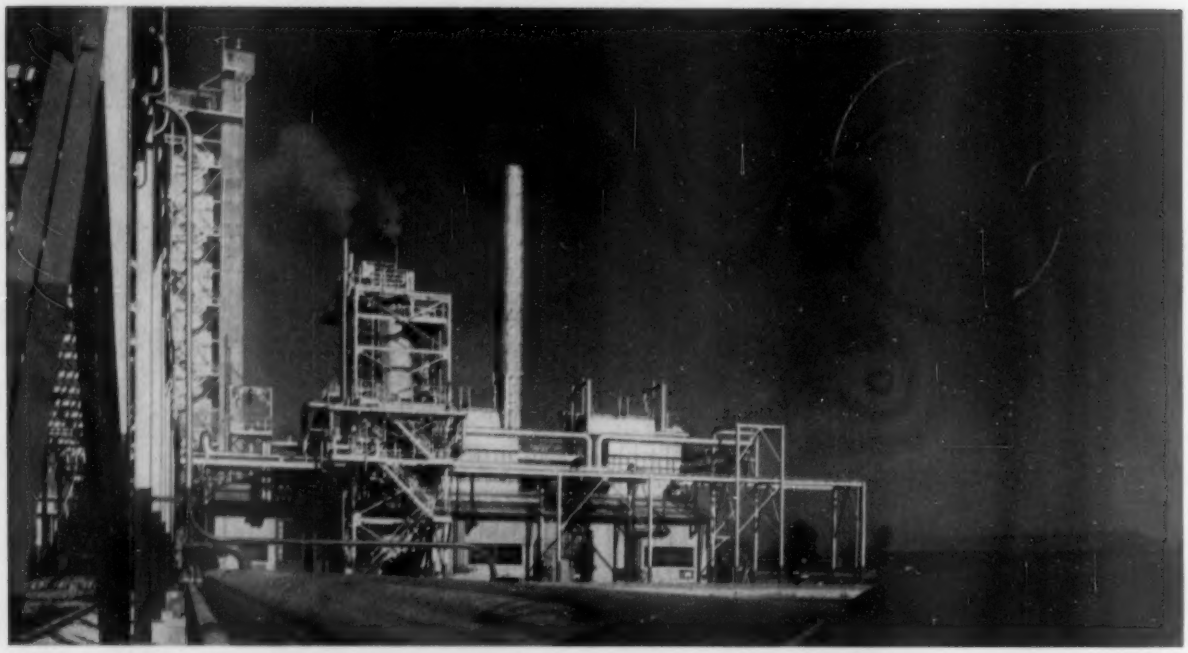
EXPLORATION—Alaska isn't going to give up her oil easily in spite of an intensive exploration program that has been carried on quietly for the past 18 months by Phillips Petroleum and Kerr-McGee. . . . Problems of climate, terrain, and animal life in the uninhabited million-acre block on the southern coast of Alaska have made the search a major logistics operation. . . . The two companies are now drilling their second well after abandoning the first as a dry hole. . . .

INDUSTRY—Looking into the future at its Golden Anniversary meeting, the Society of Automotive Engineers envisions improved engines, better and more volatile fuels, more use of multiviscosity lubes, and increased use of the gas turbine. . . . ¶An S.A.E. symposium shifts major blame for smog conditions from petroleum refiners to automotive exhaust gases and cites studies to relieve refiners of the guilt. . . . ¶Delhi Oil Corp. and Taylor Oil & Gas will merge into new $80 million integrated oil company effective February 1. . . .

NATURAL GAS—Gas producers can best be regulated by the Federal Power Commission if the commission will accept rates now in effect in thousands of sales contracts filed with the commission. . . . This recommendation came during a FPC-sponsored meeting to get advice on controlling producers under the Phillips ruling. . . . The FPC also was told current contracts are based on the competitive price of gas, the only true yardstick in determining the value of gas. . . . ¶Texas congressman starts the fight in Congress for amending the Natural Gas Act by submitting a bill that would kill the FPC's control over the gas producer. . . .

INTERNATIONAL—Mexico's petroleum industry takes another big step forward in completing new lubricating-oil and wax plant at Salamanca. . . . ¶Soviets look to growing crude production in Bashkir region to help meet future needs. . . . ¶New production is tapped in Egypt by International Egyptian Oil Co. . . .

DRILLING—Ohio Oil abandons the world's deepest well in Paloma field southwest of Bakersfield after 2 years and an expense of more than $2 million. . . . The well, plagued by fishing troubles, reached 21,482 ft. . . . ¶Texas may have a new deep-drilling record in a wildcat being drilled in Pecos County by Hunt Oil Co. . . .



NATURAL GAS through the large line in the foreground is the feed stock for the latest entry into the ammonia field, this 240-ton per day synthetic anhydrous ammonia plant of Grace Chemical Co., which was dedicated last week near Memphis.

Oil's Stake in Ammonia Gets Bigger

- Swing to petroleum-derived hydrogen for ammonia production will increase even more in next 10 years
- Immediate prospect of oversupply brought on by boom in ammonia plant building is industry's danger signal

George Weber

NEW YORK.—The oil industry is increasing its stake in ammonia in spite of the danger signals which loom for the next few years.

The industry will continue to produce more ammonia for the next decade, but the headlong plunge into this chemical field is likely to be tempered by a more cautious approach. The battle for marketing outlets is the hazard.

The swing to petroleum-derived hydrogen will extend through the next 10 years. This will keep the petroleum industry in the picture as a basic supplier and at the same time foster a stronger position in actual manufacture.

Of all the so-called petrochemicals, synthetic anhydrous ammonia today shows the greatest long range prospects for growth. Based 75 per cent on agricultural consumption as fertilizer, its future can be tied closely to population increase. On top of that, industrial requirements are turning sharply upward. This adds up to a doubling of total nitrogen demands within the next 10 to 12 years in the estimation of most conservative observers of the industry.

Long range trends . . . Over the extended future the source picture looks like this:

. . . Natural gas will continue to dominate the field for several years to come.

. . . Reformer hydrogen will enter the picture during the next few years to an unknown extent, depending on shipping costs and other factors.

. . . If gas prices continue upward, hydrogen from partial oxidation of heavy residual fuel will come into use in many areas, particularly in the Mid-Continent.

. . . Coal will return eventually by the partial oxidation process.

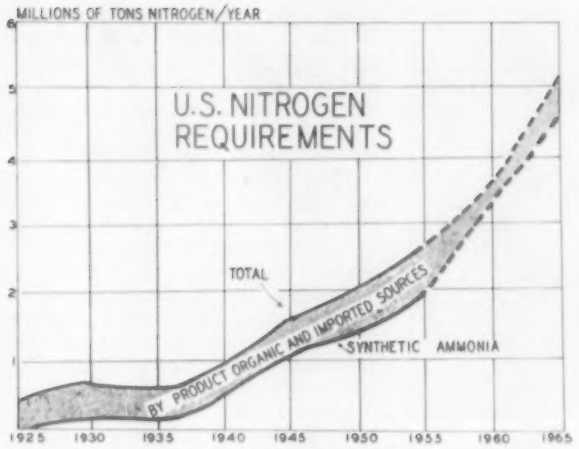
Until the day when petroleum sources cease to be competitive with coal, the oil industry will retain a growing interest in ammonia either through supply of raw materials or active participation in manufacture.

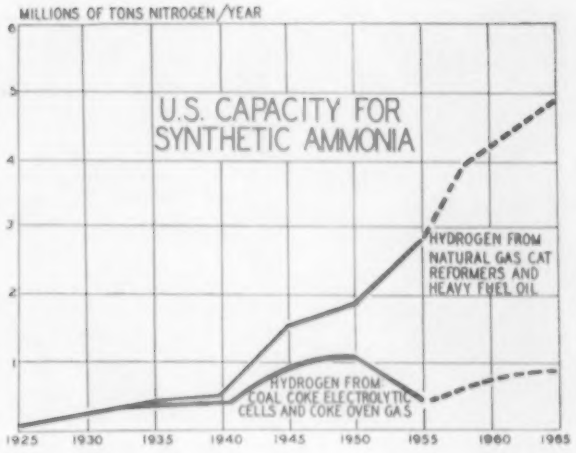
Before 1940, the synthetic ammonia industry was the exclusive domain of a handful of chemical companies. Today, the pure chemical companies control about 60 per cent of capacity while oil companies hold 28 per cent, and miscellaneous newcomers control the remaining 12 per cent. On the basis of presently known plans for expanding capacity, the oil industry will increase its interest in total capacity to about 30 per cent while chemical companies' share will shrink to roughly 54 per cent. For the next several years, petroleum-derived hydrogen will continue to supply 80 to 85 per cent of synthetic ammonia produced in this country, while coke-oven hydrogen and electrolytic hydrogen will increase in importance at the expense of hydrogen from coke by the old water gas process.

The hazard . . . The greatest hazard to oil industry is the definite prospect of a period of oversupply. This has been evident for a year or more, resulting from the record building of new manufacturing facilities to meet a continuing shortage.

The "temporary" oversupply period may last longer than many observers thought as recently as last summer. At that time it was estimated that by 1957 or 1958, the steady growth in demand would again be in line with the present spurt in building. Now it appears that this period may extend even longer.

These danger signals have caused quite a few prospective entrants into


MILLIONS OF TONS NITROGEN/YEAR
U.S. NITROGEN REQUIREMENTS
TOTAL
BY PRODUCT ORGANIC AND IMPORTED SOURCES
SYNTHETIC AMMONIA
1925 1930 1935 1940 1945 1950 1955 1960 1965


MILLIONS OF TONS NITROGEN/YEAR
U.S. CAPACITY FOR SYNTHETIC AMMONIA
HYDROGEN FROM NATURAL GAS CAT REFORMERS AND HEAVY FUEL OIL
HYDROGEN FROM COAL COKE ELECTROLYTIC CELLS AND COKE OVEN GAS
1925 1930 1935 1940 1945 1950 1955 1960 1965

the field to reconsider. Several plans which were hot a year ago, have since cooled off. Would-be participants in this growing industry must now look at a few new factors.

An important one is the prospect for longer pay-out periods for new manufacturing facilities. With its talent for mass production and its satisfaction with a relatively modest profit per unit, the oil industry has profoundly affected a number of chemical fields which it has entered. Nitrogen will probably be no exception. Although prices still remain fairly firm, the chances are that over the future, nitrogen chemicals will follow the familiar petrochemical trend toward greater production and narrowing realizations per ton.

A second factor which new ammonia producers must consider concerns distribution. The established companies in this field are not taking new competition lying down. Substantial investments are going into transportation and marketing facilities, and the newcomer will have to look far beyond his plant gates. Many oil companies are understandably reluctant to get into this marketing battle at a disadvantage to those established in the field. They are looking for outsiders to take on this phase of the business, and the decision to build several new plants will hinge on the signing of satisfactory long-term contracts for transport, distribution and retailing of nitrogen products.

Other factors which now bear more strongly on the economics of the business are adequate storage and the need for more capacity for liquid and solid derivatives of ammonia. The current oversupply is principally in ammonia itself, and most of the experienced firms in the industry are busy at a defense-in-depth which entails sizable investments for manufacture of finished products.

The boom is on . . . Despite these danger signals, the synthetic ammonia boom continues to roll. Present capacity for basic ammonia, estimated at nearly 9,500 tons per day, will be boosted by roughly 20 per cent within the next 18 months. This increase is represented by new plants and expansion of existing ones which are either under construction or firmly contracted.

In addition, nine more projects are known to be under serious consideration. While some of these may not develop within the next 2 to 3 years, it is believed that for every one that is dropped or postponed, another will turn up. Hence the prospect for 1957-58 is for a total capacity on the order of 13,000 tons per day of ammonia, or 3,926,000 tons per year in terms of nitrogen.

This near-future projection outstrips the goal previously set by the Government, but corresponds to the trend estimated by several market analysts in the field. The longer-range forecast points to a capacity of about 6,000,000 tons of nitrogen per year by 1965.

Demand keeping pace? . . . This indicates an interim period of oversupply to all but the most optimistic. A consensus of market projections from several sources shows a demand for all nitrogen requirements including by-product, organic and imported as well as synthetic ammonia, to exceed 5,000,000 tons per year by 1965.

While market forecasts can err substantially in 10-year projections, it would appear that supply from synthetic sources may be more than ample to meet the demand for much of the coming decade. One result of this will be a sharp reduction in imported nitrogen, and this reduction has been taken into consideration. On the capacity side, the brisk competition and possible narrowing of profit margins may prove too much for some older facilities, particularly those based on coke. The retirement of this type of capacity has not been plotted in the extension of the curve in the accompanying chart. Withdrawal of some sizable capacity of this type might bring about a balance between total potential supply and demand well before 1965. All observers stress the fact that projections of both capacity and requirements beyond the next few years is subject to error, and should be considered approximate beyond 1957-58.

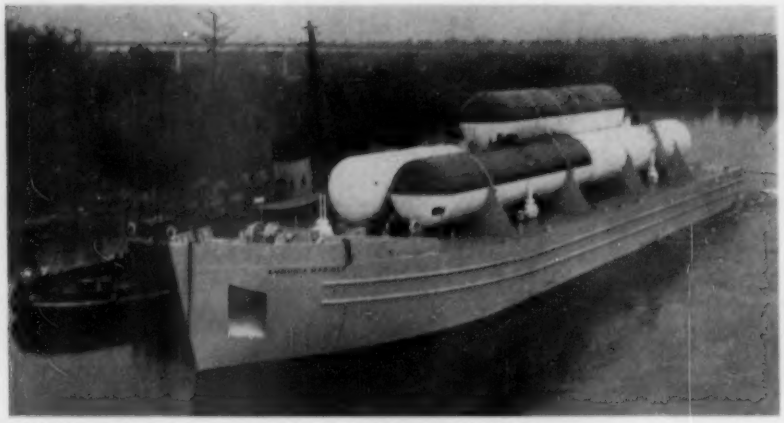
The shifting base . . . The pronounced swing from coke to natural gas as a source of ammonia hydrogen became evident during the war. While much of the military nitrogen needs continued to be met with new facilities based on coke and electrolytic hydrogen, a number of government plants built during the war years, were based on natural gas. The trend became even more pronounced after 1950, when several large plants converted from coke to natural gas.

As a result, present capacity is based about 81 per cent on natural gas. Coke still provides the hydrogen for about 13 per cent of current ammonia capacity, while electrolytic cells provide roughly 4½ per cent. The remaining 1½ per cent is based on byproduct hydrogen from catalytic reformers in refineries.

Ammonia synthesis is not wedded to natural gas. The same economic factors which brought about the swing from coke are now beginning to indicate a trend away from gas to two new sources, catalytic hydrogen and heavy fuel oil.

This turn has been called for some time, as gas costs continued to rise. The same rising cost knocked coke out of the picture. To remain competitive with 30-cent natural gas, coke would have to sell for $7.50 per ton. When it rose to $10 to $15 per ton it became economic to convert to natural gas, even in the coal-producing areas removed from natural-gas production.

Heavy fuel oil . . . Now, a third source



THE AMMONIA MARINER is the new look in ammonia transportation. She will ply the West Coast with ammonia from Shell Chemical Corp.'s Pittsburg, Calif., plant to Portland, Ore. The ammonia for agricultural uses will then be moved up the Columbia River to distribution points by smaller barge.

is coming into the picture. Considering investment and operating cost, 30-cent gas is roughly equivalent to residual fuel oil at $2.35 per bbl. If gas prices rise substantially out of line with the cost of heavy fuel oil, some new plants will be based on this heavy fuel and others will be converted over.

One such plant has already been contracted since the first of this year. Northern Chemical Industries, Inc., will build a 125-ton per day synthetic ammonia unit at Searsport, Me. It will be the first in this country to employ Texaco Development Corp.'s partial combustion process for deriving hydrogen from Bunker C fuel oil. This process has already been used in several plants using natural gas.

Before Searsport is brought on stream it is probable that an existing European operation now based on coke will have been converted to partial oxidation of heavy residual fuel. Still another project, planned by Columbia River Chemicals, Inc., at Pasco, Wash., is to be based on this heavy fuel. These projects illustrate the advantageous position which heavy fuel already holds in regions remote from natural gas and where heavy fuel is available at reasonable cost.

Reformer hydrogen . . . Meanwhile, reformer hydrogen has entered the picture strongly. It is available in growing volumes at fairly high purity and high pressures as refiners continue the record building of reformers to meet octane competition in the motor fuel market.

While this hydrogen might be considered a low-cost material, available at fuel prices, its over-all position in the ammonia picture defies generalization. In most cases, it is available in insufficient amounts to justify an ammonia plant. Further, most of it is available in the wrong geographical locations. Ammonia producers also take a dim view of the possibility of enforced downtime brought about by periodic reformer turnarounds.

The recent trend in new construction of nitrogen facilities has been toward the marketing areas of the farm belt and the East Coast. The bulk of new hydrogen from catalytic reformers is located in seaboard refineries. Hence each project potentially based on this new source of hydrogen must be judged on its own merits regarding plant costs, operating costs, and most important—transportation costs to consumer areas.

The integration of ammonia plants in existing refineries represents an advantage from the standpoint of investment and operating costs. Transportation, except in the cases of new plants building or planned in the Middle West, the Far West, and along the East Coast, is the big hurdle. Even so, the growth of ammonia capacity in the Gulf Coast or at other areas removed from markets is not to be ruled out. Some companies are shipping ammonia by tank car over long distances to compete with locally produced products, with the shipper absorbing much of the cost.

New ideas in water transport may well alter the logistical picture on ammonia. An example is the $3,000,000 investment which Shell Chemical Corp. is making in West Coast facilities to move, store, package, and distribute ammonia from its California plants to the Pacific Northwest. This project involves the building of ocean and river barges which will bring long-distance ammonia into competition with locally produced nitrogen in spite of costs involved.

A new river-rail-highway system to be inaugurated in March by Mid-South Chemical Co. at Memphis might also be taken as a sign of the distribution pattern of the future. The company will buy ammonia from four plants located in the general region. In addition to tank car and truck facilities it will operate a river barge fitted with six pressure tanks capable of handling 800 tons of liquid ammonia. The whole system will be centered on a key distribution center near Memphis.

These pioneering projects indicate two water transport possibilities which may alter ammonia logistics in favor of plants located at major sources of reformer hydrogen. One possibility is the barging of liquefied ammonia via the Intercoastal Canal and the Mississippi River system to the farm belt. This possibility is under serious consideration by some Gulf Coast producers. One potential entrant into the ammonia field, a major Gulf Coast refiner, believes it could lay down ammonia competitively in Iowa by river barge. The hitch is the company doesn't want to get into that end of the business and hasn't yet found a middle man to take over transportation and distribution.

The second possibility is the lifting of aqua ammonia from seaboard refineries as tanker ballast, for export to consumers near or en route to imported crude sources. Physically, this appears feasible. But again, the marketing problem is the knotty one. Very substantial investments would be necessary at the consuming end for storage and distribution of this form of fertilizer.

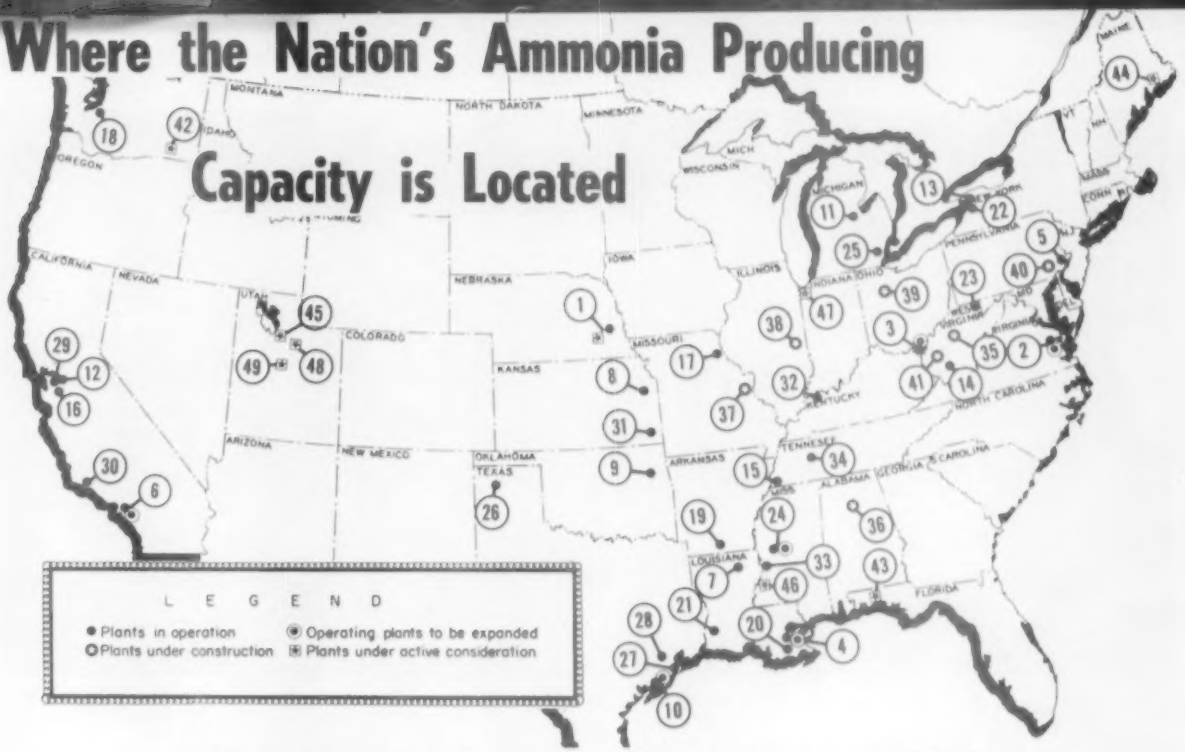
The volume of reformer hydrogen which will become available for ammonia or other uses before the end of this year is enormous and will remain a factor in future operations. Selecting only the 10 largest areas where catalytic reformers are concentrated, it appears that excess byproduct hydrogen which is presently not known to be committed to ammonia or other end uses, amounts to the equivalent of about 4,500 tons of ammonia per day.

Where it is . . . These 10 areas and the ammonia equivalent of their combined reformer-hydrogen production are:

	Tons/day
Port Arthur-Beaumont, Tex.	1,000
Houston-Bayway-Texas City, Tex.	850
Los Angeles, Calif.	600
Philadelphia, Pa., and New Jersey	450
Toledo, Ohio	300
San Francisco, Calif.	300
East St. Louis, Ill.	290
Baton Rouge, La.	275
Lake Charles, La.	200
Corpus Christi, Tex.	150

These figures are considered conservative. They exclude hydrogen already committed to ammonia manufacture in the Philadelphia and East Chicago areas and further hydrogen requirements for internal hydrogenation uses in refineries. Not included are large volumes of hydrogen from ethylene operations in the Port Arthur area.

Where the Nation's Ammonia Producing Capacity is Located



United States Capacity, Tons Ammonia Daily

Operating Plants

Map key	Company and plant location—	Hydrogen source: Petroleum	Hydrogen source: Other
1	Allied Chemical & Dye Corp., La Platte, Neb.	210	
2	Allied Chemical & Dye Corp., Hopewell, Va.	960	
3	Allied Chemical & Dye Corp., South Point, Ohio	780	
4	American Cyanamid Co., Avondale, La.	150	
5	Atlantic Refining Co., Philadelphia, Pa.	100	
6	Brea Chemical, Inc., Brea, Calif.	235	
7	Commercial Solvents Corp., Sterlington, La.	400	
8	Cooperative Farm Chemicals Assn., Lawrence, Kans.	180	
9	Deere & Co., Pryor, Okla.	180	
10	Dow Chemical Co., Freeport, Tex.		104
11	Dow Chemical Co., Midland, Mich		50
12	Dow Chemical Co., Pittsburg, Calif.		20
13	E. I. du Pont de Nemours & Co., Niagara Falls, N. Y.		30
14	E. I. du Pont de Nemours & Co., Belle, W. Va.		650
15	Grace Chemical Co., Memphis, Tenn.	240	
16	Hercules Powder Co., Pinole, Calif.	150	
17	Hercules Powder Co., Louisiana, Mo.	115	
18	Hooker Electrochemical Co., Tacoma, Wash.		70
19	Lion Oil Co., El Dorado, Ark.	570	
20	Lion Oil Co., Luling, La.	300	
21	Mathieson Chemicals, Lake Charles, La.	250	60
22	Mathieson Chemicals, Niagara Falls, N. Y.		20
23	Mathieson Chemicals, Morgantown, W. Va.		570
24	Mississippi Chemical Corp., Yazoo City, Miss.	195	
25	Pennsylvania Salt Mfg. Co., Wyandotte, Mich.		80
26	Phillips Chemical Co., Etter, Tex.	500	
27	Phillips Chemical Co., Pasadena, Tex.	450	
28	San Jacinto Chemical Corp., Houston, Tex.	120	
29	Shell Chemical Corp., Pittsburg, Calif.	330	
30	Shell Chemical Corp., Ventura, Calif.	175	
31	Spencer Chemical Co., Pittsburg, Kans.	540	
32	Spencer Chemical Co., Henderson, Ky.	220	
33	Spencer Chemical Co., Vicksburg, Miss.	200	
34	Tenn. Valley Authority, Wilson Dam, Tenn.	260	
	Total	7,810	1,654

Plants Contracted or Under Construction

2	Allied Chemical & Dye Corp., Hopewell, Va.	*135
3	Allied Chemical & Dye Corp., South Point, Ohio	*55
4	American Cyanamid Co., Avondale, La.	*150
6	Brea Chemical, Inc., Brea, Calif.	*70
10	Dow Chemical Co., Freeport, Tex.	*100
24	Mississippi Chemical Corp., Yazoo City, Miss.	*95
35	Columbia-Southern Chemical Co., Natrium W. Va.	70
36	Ketona Chemical Co., Birmingham, Ala.	125
37	Mississippi River Fuel Corp., Crystal City, Mo.	200
38	National Distillers Prods. Corp., Tuscola, Ill.	165
39	Standard Oil Co. (Ohio), Lima, Ohio	300
40	Sun Oil Co., Marcus Hook, Pa.	300
41	Westvaco Div., Food Machinery & Chemical Corp., Charleston, W. Va.	60
	Total	1,470 355

*Expansion of existing plants.

Plants Under Active Consideration

1	Allied Chemical & Dye Corp., La Platte, Neb.	*210
42	Columbia River Chemicals, Inc., Pasco, Wash.	160
43	Gulf Chemical Co., Pensacola, Fla.	200
44	Northern Chemical Industries,, Inc., Searsport, Me.	†125
45	Salt Lake Chemical Co., Salt Lake City, Utah	120
46	Simpson Coal & Chemical Corp., Natchez, Miss.	165
47	Standard Oil Co. (Ind.) & Sinclair Ref. Co., Hammond, Ind.	300
48	U. S. Steel Corp., Geneva, Utah	200
49	Utah Chemical Co., Mt. Pleasant, Utah	300
	Total	1,580 200

Plants Under Long-Range Consideration

Ammonia Chemical Corp. of California, Oleander, Calif.
Arizona Gas & Chemical Co., Northern Arizona.
Atlas Powder Co., East Coast.
Brown County Fertilizer Co., Reserve, Kans.
Celanese Corp. of America, Baton Rouge, La.
Continental Oil Co. and Cities Service Oil Co., Lake Charles, La.
Diamond Alkali Co., Houston, Tex.
Pan American Refining Corp., Texas City, Tex.
U. S. Steel Corp., Gary, Ind.

*Expansion of existing plant. †This plant was officially contracted January 6 and is scheduled for completion in the first half of 1956.

ICY BAY's terrain isn't made to order for easy exploration

Alaska Doesn't Give Up Oil Easily

- Climate, insects, rugged terrain, and bears all add to the risks and hazards of exploration as Phillips and Kerr-McGee look for oil in million-acre block

ICY BAY, Alaska—One of the most rugged exploratory efforts in the history of modern man's search for oil has been going on quietly for more than 18 months on the southern coast of Alaska.

Phillips Petroleum Co. and Kerr-McGee Oil Industries, Inc. are making a concentrated search for commercial oil reserves in a vast, million-acre area populated only by insects and bears. A capricious nature has fought back every inch of the way in an apparent effort to keep the area uninhabited.

The first wildcat in the two-company program was a stratigraphic test. It was abandoned as a dry hole last May. The second well is now being drilled about 5 miles from the site of the first test.

The Phillips and Kerr-McGee operations are not the first in southern Alaska, but they are certainly the most significant.

The first well in the Katalla-Yakataga region was drilled more than 50 years ago by the Chilkat Oil Co., which brought in 18 shallow producers before 1919—all in the vicinity of oil seeps that abound in the area. Chilkat built a small topping plant in 1914 and processed some 154,000 bbl. of crude before the operation was destroyed by fire in 1933.

How it started . . . After completing a contract with the Department of Interior, Phillips and Kerr-McGee moved into Alaska in July 1953, with the vigor that is characteristic of both companies.

Outfitting for the job was a major operation and it was done with foresight, but even the most careful planners didn't foresee some of the trouble ahead.

Kerr-McGee loaded a 215-ft. LSM with supplies at Seattle and headed for Alaska in 1953. The plan was to land the LSM and its supplies on the west coast of Icy Bay in a relatively protected area. Another LSM was to follow and be beached to serve as a dock for later unloading.

But the weather and the grinding Guyot Glacier at the head of the bay failed to cooperate. The first landing was made with considerable difficulty. A second landing was made in October, 1953, with an LST carrying the drilling rig, mud, casing and supplies. A third landing with additional drilling supplies was made late last August. The bay is choked with jagged, mammoth chunks of ice sloughed from the 125-ft. vertical face of Guyot Glacier except for short periods of time.

The entire operation has been supplied by air since that time by regular weekly flights of Cordova Airlines, plus additional chartered flights of supplies and personnel as they may be needed.

The legend on the maps of the area tell an eloquent story of the region. Under "Road Classification" are both "all weather" and "dry weather" road categories. As listed they are: Hard Surface—none; Improved Dirt—none; Unimproved Dirt—none, and Trails—none.

Road building . . . The drilling crews became road builders almost overnight. They found problems that would make any good road engineer tear his hair. About 8 miles of road which they built along the beach west of their airstrip and camp was washed out almost im-

Journal Index Ready

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Felling timber and cutting a swathe in woodland is the first step in Alaskan road building. Then . . .

Brush stripped from the felled trees is spread on the roadway to form a matting for heavier timbers that are used to . . .

Corduroy roadway built from the Icy Bay landing beach to well sites. More brush tops the timbers and . . .

Gravel from pits dug by the road-building crews tops off the brush and timber to furnish a passably all-weather surface.

mediately and is now listed as "impassable."

They moved farther inland and started again—on a 24-hour basis. Unconsolidated sediments, water-soaked and soggy from constant rainfall and held on the surface only by vegetation, oozed and ran like a stream of mud once a bulldozer blade cut through the crust.

Road building soon settled into a familiar pattern. Bulldozers pushed over the timber along the road route. Boughs from the trees were stripped and laid atop the corduroy bed which was rip-rapped and then gravel was added. Crews dug two gravel pits building to the first two drilling sites. Wherever possible the road followed stream courses and the rocks and boulders in stream beds were shoved out and onto the soggy terrain to help make a roadbed.

Almost immediately the road builders acquired a multitude of grateful fans among the local inhabitants—the Kodiak bears. The bears appreciated the efforts of the road crews. Today they probably wonder how they ever managed to exist in their native wilds without the luxury of a few well-built roads. Just as soon as a stretch of road was completed, the bears adopted it and abandoned the rougher going of the brush.

In every crew, one man carries a bear rifle. No one has yet tangled with a bear, but it has been necessary to kill a few to halt camp and supply raiding.

Another "wildlife" problem involves "critturs" considerably smaller than the bears but much more troublesome. Two types of insect pests descend on the drilling crews at different seasons, adding to the general discomfort.

Operating personnel swear that the southern Alaska coast nurtures the biggest and most voracious mosquitoes found anywhere in the world. The other pests are a breed of winged gnats so small the Alaskan Indians call them "no-seeums." They are reputed to be equally as bloodthirsty as the mosquitoes.

The weather . . . The root of most of the trouble has been the weather. The warm Japanese current moves northward into the Alaskan coast. The warm, wet air it carries is forced upward rapidly as it encounters the steep slopes of the mountain ranges that skirt the coastline. This updraft of warm air creates the southern Alaskan climate.

It has not been extreme cold that has created problems, but a combination of rainfall and snow and all that excessive moisture does to the terrain. The average mean temperature in the area in January is a mild 26°.

The annual precipitation, however, is about 150 inches. October averages an inch of rain a day.

In the winter months, the temperature fluctuates, causing streams to freeze from the bottom and keep building up. A stream running only 6-in. of water may build up 6-ft. of ice during the winter. The ice is honey-combed with air pockets and at times with running water. This fragile, icy network won't hold up equipment, and crossing streams is a hazard.

In March, when weather halted road-building activities, the crews were put to work at the job they went to Alaska to do—drilling a well. Since the road to the location they wanted hadn't been finished, Phillips and Kerr-McGee picked a location they could reach.

Once again, planners failed to get the cooperation of the weather. As the crews were rigging up for the Sullivan Strat No. 1, it began to snow. A bulldozer had to clear the road ahead of them every day. Finally, when 7 ft. of snow had hidden the equipment on the ground and a rain had packed one

SCENERY is downright awe-inspiring, but the grandeur itself makes jobs like building roads and clearing drilling locations tough ones.

snow to a hard-frozen 5 ft. of ice, topped almost immediately by another 30 in. of snow, the whole operation came to a halt.

Most of the crew was eligible for a vacation in a month, so the men were flown back to the states and the drilling equipment left where it was until the snow melted.

Late in March, more rains and milder temperatures took care of the snow, and drilling on Sullivan Strat No. 1 began in early April. The well was completed as a dry hole in mid-May at a total depth of 4,837 ft.

The access road to the location for Sullivan No. 1, 5 miles west and 2 miles north of the Sullivan Strat No. 1, was completed and the second well was spudded on June 19.

The rig used for both wells is complete with all auxiliary equipment capable of drilling to 10,000 ft.

Special equipment . . . Other equipment shipped to Alaska consists of aircraft, marine, construction and general automotive units. It includes a small airplane, an LCM, three tractors, a scraper and a motor grader, a mobile crane, three Athey wagons, and two half-tracks.

The automotive equipment includes a platform trailer, a combination pole-trailer and pipe-dolly, two 30-ft. tandem trailers, two power wagons, three jeeps, a station wagon, and five trucks.

Personnel . . . The Alaskan crew has averaged more than 30 men, including the project manager, a drilling superintendent, two drillers, 13 drillers helpers, a rig mechanic, a mechanic welder, four equipment operators, a truck driver, a boat operator, a pilot, one clerk, one medical aide, two camp utility men, mud engineer, geologist and logging equipment operators.

The men live in eight trailer houses and a number of prefabricated buildings at the main drilling camp located two miles down Little River from the Sullivan No. 1. They are supplied with food and laundry by the Universal Food Service, a Seattle catering firm. A new airstrip has been constructed near this camp.

Geology . . . Phillips sent four surface geological crews in July, 1953, and the following month shipped two helicopters for use in the rugged terrain. Eleven geologists worked during the field season of 1954, based at camps built at Yakataga and Katalla.

Work of the geological crews has been devoted largely to verifying work already done by the U. S. Geological Survey and adding detail. The Sullivan anticline, present scene of activity, was mapped years ago by the USGS. It is faulted and highly complicated. *(For details on the geology of the area, see The Oil and Gas Journal, April 14, 1952, page 124).*

DRILLING the second well upriver from Alaska's southern coast, Phillips and Kerr-McGee hope to find commercial oil reserves beneath that rugged terrain.

The leases . . . The Phillips-Kerr-McGee operating rights cover a total of 1,063,884 acres, including 504,039 in the Katalla District and 559,845 in the Yakataga District. Phillips and Kerr-McGee together hold leases on only 5,151 acres.

A block of 1,023,114 acres was assembled by Northern Development Co., a partnership formed by William T. Foran and Ben G. Gellenbeck to represent 416 holders of leases in the area and develop a plan to open it for drilling.

Nearly 2 years were required to lay the groundwork. First, negotiations to interest another major company in testing the area were made, but that company failed to reach an agreement with the Department of the Interior on a contract.

Northern Development then approached Phillips and entered into an operating agreement. Phillips combined the Northern Development acreage with 40,770 acres held under an operating agreement with Alaska Petroleum Inc. and entered into a development contract with the Department of the Interior, which was approved February 6, 1953. Kerr-McGee's interest was obtained under contract with Phillips.

The contract . . . The contract with the Department of the Interior provides that Phillips and Kerr-McGee spend $1,200,000 for exploratory work by June 30, 1956. The cost of wildcat wells may be included, but not that of development wells.

By that date the companies must have begun drilling a wildcat in each district or give up all acreage in the district in which drilling has not been started. Since the Yakataga area already has been drilled, only one more test hole—in the Katalla District—is required by mid-1956 if they wish to keep all of acreage.

In each of the three years following mid-1956, the companies must spend for exploratory work, including the drilling of wildcat wells, an amount equal to 40 cents for each acre retained, and start an additional wildcat well in each district before the middle of 1958, 1960, 1961, 1962 and 1963, or forfeit all acreage within the district in which a well is not started except that committed to approved units.

Proration Plan Dropped

Fight for market-demand production formula abandoned in Colorado and Wyoming; Nebraska legislation pushed

DENVER.—The Rocky Mountain Oil and Gas Association has abandoned proposals for market-demand proration legislation in Colorado and Wyoming this year.

The association will continue its sponsorship of such legislation in Nebraska.

The Colorado - Wyoming proposals were killed following a recent association meeting called by W. W. Flenniken, president of the organization, at the request of 43 members—mostly independent operators.

The R.M.O.G.A. plan for market-demand proration carried by a slim margin, 67-51.

Flenniken called a special session of the association's executive committee the following day. The committee recommended that the Colorado-Wyoming proposals be modified to withdraw the market - demand formula and provide for ratable take from fields, maximum efficient recovery, and correlative rights.

The status . . . The watered-down recommendations were mailed to 100 association directors and members of legal and operating committees in seven states for a vote.

However, the effort to get a proration law passed in Wyoming this year appears to be futile. The state's 40-day legislative session opened January 11, and the deadline for introduction of proposed legislation is January 31. Colorado's 120-day assembly session began January 5, and Flenniken said he believed the association could offer the revised plan in time for action.

A conservation bill introduced in the Nebraska Legislature last week called for creation of a three-member, nonpaid oil and gas conservation commission named by the governor for 3-year terms.

The commission would have power to regulate drilling, producing, and plugging of oil and gas wells. The commission also would order the spacing of wells. The state geologist would serve as state oil and gas conservation director. The measure also would levy a tax of not more than 2 mills on the dollar value of oil and gas produced to support activities of the department.

The argument . . . The association group opposing market-demand proration was headed by R. S. Shannon, Denver, an independent and former association vice president for Colorado.

Shannon warned that association sponsorship of the legislation would split the organization, with independents fighting major companies. Other opponents maintained that a proration law would retard exploration and would encourage oil imports.

H. B. Gernert, Trigood Oil Co., Casper, Wyo., former R.M.O.G.A. president, led the faction arguing for continued sponsorship of the legislation.

"Only the major companies can survive in the absence of proration," he contended.

Unit Clause Upheld

Appeals court reverses U.S. district judge in Utah case

DENVER. — The unit or pooling clause in Rocky Mountain and Mid-Continent area lease forms was upheld as "fair" and "vital" here last week by the U. S. Tenth Circuit Court of Appeals which reversed the ruling of a Utah federal judge.

The court's unanimous decision, written by Chief Judge Orie L. Phillips, said "the practice of unitization by a power granted the lessee in advance . . . will be fair and profitable to the lessor and lessee and is vital to the oil and gas industry in the interests of the conservation of both natural and material resources."

U. S. District Judge Willis Ritter held in the Utah decision that the unit clause is "too indefinite and uncertain" to be enforceable. The appeals court ruling conceded "the grant of power is in general terms," but added:

"It should be upheld . . . because it is subject to implied terms that will prevent arbitrary and unfair dealing. . . ."

The decision was regarded so vital to the oil industry that five oil and gas associations joined with Phillips Petroleum Co. in appealing the case. Judge Ritter's ruling was viewed as a real threat to all long-term oil and gas leases. He said the leases violate the ancient legal principle prohibiting transfer of lands to heirs or assigns with restrictions for more than the life of a person plus 21 years. This legal rule is usually applied to wills which attempt to govern the actions of people in future generations. *(The Oil and Gas Journal, September 6, 1954, page 73.)*

What was involved . . . The case started soon after several companies tried to set up a field-wide unitization program for Roosevelt pool in Uintah County, Utah, with Carter Oil Co. as the operator. Thirty-two owners of land on which Phillips holds leases in the 34,000-acre exploratory unit objected to the plan.

Phillips went into the Utah U. S. district court attempting to enforce the terms of its leases and the judge dropped his legal bombshell. Since the material facts involved in all the 32 leases were the same, the question was appealed in only two cases.

Attorneys representing the Mid-Continent Oil and Gas Association, Rocky Mountain Oil and Gas Association, Western Oil and Gas Association, North Dakota Oil and Gas Association, and New Mexico Oil and Gas Association filed a joint brief in the case. The associations battled only Judge Ritter's ruling involving the "rule of perpetuities." The "too indefinite" ruling was fought by Phillips alone.

Montana Leases Canceled

HELENA, Mont. — Montana's $2-an-acre nondrilling penalty has caused a mass cancellation of land auctioned at the state's largest state-owned oil and gas land letting 3 years ago.

Records of the State Land Board show that more than 80 per cent of the land leased in January 1952 has been cancelled.

The leases sold in 1952 were largely on untested Daniels County land following the Tioga discovery in the Williston basin in July 1951. Of 278,000 acres leased in the county, only 45,223 remained under lease last week.

Williston Has Good Strike

MINOT, N. D. — Ward - Williston Drilling Co. has come up with the best well to date on the United States side of the northeast flank of the Williston basin.

Ward-Williston's 3 State A in North Westhope field, Bottineau County, flowed 384 bbl. of oil daily through a 16/64-in. choke. The well is just a few miles south of Manitoba. Production is from the Charles sand, which was topped at 3,218 ft.

S.A.E. Looks at Future

Celebrating its Golden Anniversary, Society of Automotive Engineers stresses engines and fuel needs of tomorrow

George Weber

DETROIT. — Celebrating its fiftieth year, the Society of Automotive Engineers last week paused to review the past, present and future. In the first of 11 Golden Anniversary Meetings scheduled for 1955, the society took a long look into the next half-century to visualize progress in engines for land and air use.

The endeavors of the coordinating research council supported jointly by S.A.E. and A.P.I. will continue to be of prime importance.

T. A. Boyd of General Motors Research Laboratories outlined several fields where this cooperative effort of the two industries will be needed. A better corrective for combustion deposits and the surface ignition resulting from them must be found.

Lubricating oils which will minimize the octane requirement increase in high compression engines must be provided. Further insight into the oxidation mechanism in gasoline components must be had in order to devise better means for predicting storage stability. The oxidation-corrosion stability of lubricating oils must be determined with simpler and less time-consuming tests.

Boyd also called for further knowledge on the composition of automotive engine exhaust gases to improve the total fuel combustion. The mechanism of combustion occurring in gasoline, diesel and gas turbine engines must be better understood. The molecular structure in lubricating oils and their physical properties such as change in viscosity with temperature must also be more fully investigated. Boyd noted that some of these problems are now being partially solved, but called for added effort on the part of both industries through their coordinating research council.

Knock control . . . A research project on the effect of gasoline and lube composition on knock control has shed new light on a method for coping with high compression engines.

Five Standard Oil Development Co. men eliminated higher boiling components of gasoline and found the high volatility fuel reduces octane requirements when used with multiviscosity lubricants. In nearly 250,000 miles of controlled fleet testing under normal driving conditions, they found it feasible to operate 9.5:1 and 10:1 compression ratio cars on 98 to 99 research octane fuel of the proper volatility using a multiviscosity lubricant.

In contract they say high compression ratio engines build up octane requirements of 100 or more if operated on conventional fuels and lubes.

Aviation . . . The next 50 years of aviation the whole world will be reachable within a day, Dr. Arthur L. Klein, aeronautics professor at the California Institute of Technology, says. This implies an average flying speed of 1,000 miles per hour, which will be attained long before 50 years elapse, he said.

If extra-terrestrial flight is to be achieved, something is required to replace chemical fuels. There are no other serious difficulties except the financial one.

The helicopter will come into its own, with improvements in reliability and safety which will result in reduction in cost. Our present instrument flying must be replaced by something less burdensome, to give the pilot a 3-D type of presentation so that he will have a natural view of the situation.

Metallurgy should develop alloys at least twice as strong as those we are now using. As a result, the aircraft of 50 years hence will be as superior to present craft as today's are to those of World War I.

Gas turbines . . . Gas turbines for trucks and tractors should see increased use in the future. The possibilities of this type of power for tractors and earthmovers should not be dismissed, said C. E. Frudden of Allis Chalmers Mfg. Co. While weight saving is not too important, the saving in space and the means for cooling are attractions in the gas turbine.

The gas-turbine engine weighing about one-eighth as much as similar horsepower gasoline or diesel engines has proven practical in experimental trucks handling heavy highway loads. The remaining disadvantage, fuel economy should be overcome by engineers within the near future.

Railroads . . . The railroads may set the stage for greater use of cracked distillates in automotive type diesel engines, said C. G. A. Rosen, S.A.E.'s

Tanker Gets First Look at Golden Gate

Tide Water Associated Oil Co.'s new tanker, the S. S. Flying-A-Washington, recently completed its first trip from the East Coast to West Coast in 22 days. The ship arrived in San Francisco with a cargo of gasoline picked up at Baytown and Houston. The $6 million vessel has a capacity of 131,000 bbl. of liquid cargo. It is one of four tankers added to Tide Water's fleet last year. The other ships include a sister ship and two supertankers. The Washington will be used primarily in Tide Water's Pacific fleet.

new president, says. He notes increasing availability of cracked distillates resulting from the conversion of more and more of the heavy residual fraction to light higher-valued products. The railroads, in order to hold the line on fuel costs will open the way for greater use of this available cracked distillate as diesel fuel, by relaxing their specifications.

He cites the growing use of pilot ignition which permits the use of lower cetane number fuels. There is much interest in engine developments which will eliminate the need for cetane numbers.

The combination diesel-gas turbine engine is growing in interest. Rosen cites 8 development projects on this combination power package. The new concept that ignition occurs before 10 per cent of the droplet has been vaporized is gaining acceptance. This seems to be verified by the new MAN "Whisper" engine from Germany, which is claimed likely to revolutionize the automotive diesel field. Operation of this engine is believed to take place without the cracking of fuel.

New developments in turbo-supercharging of both 4- and 2-cycle diesel combinations will result in higher performance. These will also demand new lubricants with greater oxidation resistance. Undoubtedly, the diesel will have worthy competition in the gas turbine, and eventually with plants powered with atomic and solar energy. Each category of power plant will find its useful sphere of influence, and the imaginative designer of the future may well initiate radically different approaches to the fundamental problems of diesel power.

Smog Blame Shifts

S.A.E. symposium points finger at automobile exhausts; changes in engine design hinted as answers to problem

DETROIT.—The oil industry, having cleaned its own house with efficient air-pollution controls, is now substantially relieved of primary blame for smog in Los Angeles.

The blame for the problem appears to be swinging away from the weary petroleum refiner as the finger points more and more to the city's 2,211,600 motor vehicles.

At a symposium on air pollution at the Golden Anniversary meeting of the Society of Automotive Engineers here last week, the consensus seemed to be that vehicle exhausts contribute most to the problem.

The peculiar atmospheric conditions over Los Angeles are now firmly established as the factors which permit the accumulation and conversion of man-made wastes to the eye-smarting smog. Experts on the subject consider that area a case apart. They do not believe that other industrial and population concentrations will necessarily have the same problem as automobile traffic grows.

Smog attacks may hit other communities under rare occurences of temperature inversion and heavy atmospheric pollution. They may be equal or greater in severity, but not in frequency. Nor could they be blamed on the same causes. Improvements in industrial pollution control in Los Angeles have served to accentuate the remaining factors, including vehicle exhausts, and trash burning. While the growing traffic problem may share in similar problems elsewhere, it is believed to represent a lesser factor.

Real causes . . . In spite of all this the automotive industry is facing up to the responsibility for Los Angeles smog. The outcome may be not only a reduction in pollution but a sizable conservation of motor fuels. Not only was vehicle exhaust frankly cited as the prominent contributor to smog in that city, but research has pinpointed the causes and has indicated some possible solutions.

Now, the presence of hydrocarbons and nitrogen oxides are isolated as the principal elements in a smog attack. Los Angeles County's Air Pollution Control District concludes that removal of all hydrocarbons from refineries and from the distribution of gasoline will not lower the concentration of hydrocarbons in the downtown area and the north-central section of the county. That civic body recognizes that hydrocarbons must be removed and the efficiency of removal must be extremely high.

Further support for this conclusion came from A. J. Haagen-Smit of California Institute of Technology. Exhaust gases from the cruising and accelerating automobile engines formed ozone photochemically on addition of nitrogen dioxide. He found concentrations of exhaust gases were of the same order as those measured in the Los Angeles atmosphere.

Representatives of Stanford Research Institute conducting research for the Western Oil and Gas Association offered similar data which tend to take the blame from refiners. While 50 per cent of the roughly 3,000 tons of organic contaminants dumped into the Los Angeles atmosphere daily, are petroleum hydrocarbons, 70 per cent of these entered the air through automobile exhausts. Only 30 per cent could be blamed on the producing, refining and marketing divisions of the industry. This was supported by relating total gasoline consumption to the growth in the smog problem.

Role of engines . . . It is possible the trend toward automatic transmissions and lower rear axle ratios in newer automobiles may reduce atmospheric contamination from vehicles. General Motors Corp. research outlines factors contributing to high hydrocarbon losses through the tailpipe, and points to means for reducing them.

Studying the effects of engine-fuel variables on hydrocarbon content of exhaust gases, F. G. Rounds, P. A. Bennett and G. J. Nebel found idling and deceleration of automobile engines cause the most trouble. An average of 4 per cent of hydrocarbons was found in exhaust gases during idling, with the highest content at rich mixture. They estimated that this loss could be reduced 30 per cent if cars were adjusted for best idling fuel-air mixture.

In decelerating tests, they found hydrocarbon contents in the exhaust directly resulting from manifold vacuum. Since manifold vacuum is a factor of engine speed, the lower engine speeds in newer cars will tend to reduce this cause of atmospheric pollution and fuel waste.

No other variables such as compression ratio or engine type had any significant effect on hydrocarbon content of exhausts. Of particular interest to the oil industry, it was noted the type of fuel had no effect either. Comparing diesel, gasoline and L.P.G. coaches, they could not find any significant dif-

Cat Crackers Still Blamed

LOS ANGELES. — Despite the swing toward blaming automobile exhausts for the bulk of Los Angeles smog, the Los Angeles Air Pollution Control District is still critical of some cat-cracking units.

Richfield Oil Corp. was recently denied a permit to operate a 35,000-bbl. fluid unit at Watson, and Standard Oil Co. of California has been denied permission to operate its 40,000-bbl. cracker at El Segundo.

Both companies have appealed the rulings.

ference attributable to the type of fuel used.

What to do? . . . While research has not yet progressed to the point where definite recommendations for engine design changes are in order, some possibilities were hinted. These might alleviate the smog problem in Los Angeles and render the streets of other cities a little more palatable as well.

The growing use of the overhead valve V-8 engines will help, since these engines idle acceptably with leaner mixtures than the older sixes and eights. Automatic transmissions will also help, by reducing engine speeds, especially during deceleration. Lower axle ratios will tend to do the same.

One particular modification which may prove important is a device which would shut off the fuel during deceleration. General Motors' J. T. Wentworth and W. A. Daniel mentioned this conclusion. A carburetor modification admitting additional air and fuel to the intake manifold during deceleration would also reduce contamination and waste, they found. The fuel shut-off however was considered a more efficient means.

Whether the frank admission of these findings by the automotive industry will give rise to a "Los Angeles" type of carburetor or other mechanical means for reducing atmospheric pollution, remains for further study. The significance of the progress in the research program centered on that smog-ridden city is that guessing and expedient name-calling has given ground to scientific reasoning.

Of further significance is the possibility that widespread application of some of the suggested modifications in engine design may serve also to improve vehicle mileage. It was estimated that the emission of hydrocarbons could be reduced by about 3 per cent by practical means. This would entail a hardly noticeable saving to the average motorist, but could amount to a sizeable conservation figure on a nation-wide basis.

Fuel Choice Analyzed

Canadian airline tells S.A.E. that JP-4 fuel has cost, safety, and efficiency edge over aviation gas, kerosine

DETROIT.—Trans-Canada Airlines will use JP-4 to fuel its new Viscount turboprop passenger planes rather than gasoline or kerosine and the reasons for the choice were outlined here last week at the national meeting of the S.A.E.

Paul E. Lamoureaux, of T.C.A., said gasoline was eliminated for two reasons. While it can be justified by the military in some cases, its relatively high price places it beyond the commercial airline's budget. The high volatility and resultant problems involving boiling served further to rule out avgas.

The wide-cut JP-4 showed definite advantages over kerosine on several counts. The most important point from the airline's viewpoint was safety, and safety in the air is of first priority.

With its higher spontaneous ignition temperature, its lesser tendency to creep, and the built-in safety factor of its —76° F. freeze point, JP-4 was the choice over kerosine. During refueling and in case of crashes, Lamoureaux sees little to choose between the two.

Safety factor . . . Lamoureaux made no claim that JP-4 is a safe fuel—there is none, he said. JP-4 is just as hazardous as present day gasolines. Despite some advantage that kerosine may have because of its higher flash point, the airline concluded these occasional advantages are more than nullified by the new hazards arising from kerosine's other properties.

Trans-Canada anticipates no fuel boiling problem since its Viscounts will never be flying above 30,000 ft. and seldom above 25,000 ft. The company believes that its turbines should operate cleaner with JP-4 and be less likely to carbon up during their 750 to 1,000-hour service periods between overhauls. The engine and associated systems will operate equally well in the Viscount on either fuel, once set up for the selected grade.

Present supplies of aviation kerosine in Canada average 18,550 B.t.u. per lb. as compared with 18,875 B.t.u. per lb. for JP-4. Since the Viscount is weight-limited and not volume limited, use of the JP-4 means an added 140 lb. of payload on the Toronto-New York run. On other routes and under adverse wind conditions this advantage could increase to 240 lb.

Price advantage . . . While Trans-Canada made its decision on the safety and operational factors, the comparative prices of the two fuels further supported the use of JP-4. Aviation kerosine would cost an average of 1.5 cents per Imperial gallon more. This would amount to a yearly fuel bill for the 15 craft, of about $190,000 over that for JP-4.

Availability, competition in manufacture, standardization with the military and numerous hidden costs added further points in favor of JP-4. Aviation kerosine can be made by fewer refiners from a relatively limited group of crudes. JP-4, available from more refiners at a greater range of locations, should present a better long-range cost picture.

The decision of the Canadian military in favor of JP-4 further decided Trans-Canada. This would eliminate the need for separate handling and manufacturing facilities in many cases, and the company would have the further advantage of continued military research on that fuel.

Vapor Lock Answers

Three obstacles bar more volatile motor gasolines

DETROIT.—The petroleum refiner could save American motorists an estimated $100,000,000 a year by marketing more volatile gasoline. The refiner and the natural-gasoline producer would be happy to do so, but three principal obstacles need to be cleared first.

These conclusions were voiced last week at the S.A.E. annual meeting by D. P. Heath and R. H. Thena of Socony-Vacuum Oil Co., and by Gilbert Way of Ethyl Corp. In a joint paper on passenger-car vapor lock, the authors put the finger on three roadblocks to better utilization of the nation's abundant light hydrocarbon blending components.

They criticized:

. . . Use of Reid vapor pressure as the sole procedure for controlling vapor locking tendencies of motor gasolines, recommending that A.S.T.M. distillation data also be considered in volatility ratings. A realistic determination of the vapor/liquid ratio can be made by taking both of these factors into consideration. This concept, the authors said, would permit the wider use of volatile blends without increasing the incidence of vapor lock.

. . . Poor design of fuel systems for a few car models. A few models, which are exceptionally prone to vapor lock, depress the volatility of all gasoline since the refiner must design his fuel to meet their extreme needs.

. . . Arbitrary restriction placed on Reid vapor pressure in some marketing areas. This prevents the refiner from passing on the benefits of better fuels to motorists. It could be overcome, the authors said, by alteration in the

A.S.T.M. and federal specifications for motor gasoline to include a more realistic control of the vapor locking tendencies of motor gasolines.

Uranium "Flooded"

Radioactive element in old oil field stirs excitement

TULSA. — Climax Molybdenum Co. will continue routine oil production from its recently acquired shallow fields of northeastern Oklahoma, despite widespread excitement flared by reports indicating the property may have valuable uranium deposits.

Company officials calmly discounted claims by a Texas oil man that he had obtained uranium in commercial quantities from a sand filter through which water was circulated before being returned to wells in a Nowata County water-flood project.

Climax Molybdenum spokesmen said the company had no thought of finding uranium there when it bought the property 3 weeks ago *(The Oil and Gas Journal, January 3, page 70)*. One company official emphatically said he does not believe uranium is present in commercial amounts.

Stock soars . . . But cautious warnings from Climax were not sufficient to offset the get-rich-quick dreams prompted by publicity given the uranium "discovery" in mass-circulation magazines. Even Samuel Labon Shepherd—the Dallas man who found the deposit—appeared less excited than some stock speculators.

Climax stock rose 12½ points before starting back down last week.

Occurrence of uranium in oil formations is not a rarity. Several other companies have found small deposits of radioactive material under similar circumstances. Geologists with Stanolind Oil & Gas Co., for example, frequently have found a "highly radioactive" element in lime deposits adhering to old casing pulled from stripper wells. These deposits have been small, however, and were not considered to be of commercial importance.

Importance of the Nowata County deposit also was discounted by D. B. Taliaferro, branch production chief of the U. S. Bureau of Mines at Bartlesville, Okla. He explained that the small amount of uranium found by Shepherd apparently has accumulated over a long period from large volumes of water filtered through a small volume of sand.

Climax Molydenum's acreage in northeastern Oklahoma was acquired in a $5,000,000 purchase from William J. Sherry, Tulsa oil operator. The property formerly was owned by Whitehill Oil Corp., Tulsa.

Pipeliners Convene

Canadian prospects among topics at annual meeting

LOS ANGELES. — Delegates to the seventh annual convention of the Pipe Line Contractors Association this week will have their eyes focused on Canada, scene of several big gas-transmission systems to be built in the next few years.

G. A. MANUEL

G. A. Manuel, president of the association, predicted an attendance of more than 500 pipeliners at their annual convention, which will be the first ever held outside the Southwest. Manuel is president of Williams-Austin Co., Pittsburgh.

N. E. TANNER

R. A. MacKIMMIE

Two of the principal speakers at the 3-day meeting in the Statler Hotel will discuss the pipeline industry's future in Canada. N. E. Tanner, president of Trans-Canada Pipe Lines, Ltd., will discuss "Outlook for Pipelining in Canada" at a general session Tuesday morning. Laws and regulations governing pipeline construction in Canada will be discussed Monday morning by R. A. MacKimmie, Calgary attorney.

Other speeches will include "Construction Methods on 36-in. Pipe," Raymond H. Crowe, chief engineer, Transcontinental Gas Pipe Line Corp.; "Code for Pressure Piping," Frederic A. Hough, Bechtel Corp.; "Fundamentals of Safety in Pipeline Construction," Bennie G. Pierce, safety director, H. C. Price Co.; and "The Association's Safety Program," John H. Williams, president, Williams Brothers Co.

Court Has Stanolind Case

TULSA.—Stanolind Oil & Gas Co.'s request for an injunction to prevent the Federal Power Commission from applying its new gas regulations to most of the company's producing and gathering operations has been taken under advisement by the United States District Court here.

Government attorneys, opposing the petition, argued chiefly the question of jurisdiction, contending that federal district courts have no jurisdiction and that appeals from FPC actions must be brought in federal circuit courts.

The circuit court in New Orleans has granted injunctions against FPC in cases brought by Magnolia Petroleum Co. and Ohio Oil Co., but the circuit court in Denver refused to grant an injunction asked by Amerada Petroleum Co. A lower court in the District of Columbia issued an injunction at the request of Union Producing Co. These are all temporary stay orders, and none of the cases has yet been heard on its merits.

Stanolind is the first company to bring action in a federal district court, and the outcome of its case is being watched by the industry with great interest as possibly setting a pattern for getting a review of FPC orders.

Industry Briefs

HOUSTON.—Texas - Empire Pipe Line Co., a pioneer in crude hauling by pipeline, has changed its name to Texaco-Cities Service Pipe Line Co. The change was made to better bring out the names of its owners. The line, originally built as a 12-in. carrier in 1929, is now capable of moving 216,000 bbl. daily to the East Chicago, Ind., refining area. During the first 25 years of its operation, the line moved more than 1 billion barrels of crude.

DALLAS.—Landa Oil Co. has acquired all oil and gas properties of L&G Oil & Royalty Co. The stock sale involved working interests in production and leases in Texas, Louisiana, Mississippi, Oklahoma, New Mexico, and California. William F. Lynch, president of Landa Oil, will be the new president of L&G.

SALT LAKE CITY.—A syndicate which includes Utah Gov. J. Bracken Lee, several Utah businessmen, and Hollywood movie stars has sold oil holdings in Weston County, Wyoming, to Mountain Mesa Uranium Corp. for $6,500,000.

SCOTTSBLUFF, Neb.—The Scotts-bluff city council has voted to call for bids on leasing 1,754 acres of city airport land for oil and gas exploration. The council acted after Charles Niblak, Casper, Wyo., said a major oil company he represents would consider paying $2 an acre bonus for the lease, plus a yearly rental of $1 an acre. Niblak declined to identify his client. A date for the leasing will be set after the city checks with the Civil Aeronautics Administration on legal aspects of the leasing.

Gas Prices Defended

FPC told present tariffs reflect competitive value; producers also warn against using power to lower rates

WASHINGTON.—The Federal Power Commission was told last week how it can solve the problem of regulating natural-gas producers. It's simple—just accept the rates now in effect in thousands of contracts filed with the commission.

Industry spokesmen pointed out the prices quoted by producers are based on the competitive value of the gas. They said competition is the only fair yardstick to use in measuring the price or value of the gas.

The recommendations came during a hearing called by the FPC for advice on how to regulate producers under the Supreme Court decision in the Phillips case.

While the industry wants prevailing prices to continue, representatives of cities, states, and utility consumers want something else. They advocate rigid control, claiming that gas prices would soar if producers are left free to sell their gas without FPC control.

The industry was backed by representatives of banking institutions and insurance companies. More than 50 persons paraded before the commission during the 2-day hearing.

The major industry arguments were presented by David Searls, Houston attorney; Earl Brown of Magnolia Petroleum Co., Dallas; and J. A. O'Connor of the Murphy Corp., El Dorado, Ark., on behalf of the Mid-Continent Oil and Gas Association, American Petroleum Institute, Western Oil and Gas Association, Illinois Oil and Gas Association, Rocky Mountain Oil and Gas Association, Oil Producers Agency of California, New Mexico Oil and Gas Association, North Texas Oil and Gas Association, and West Central Texas Oil and Gas Association.

Phillips' spokesman . . . Rayburn L. Foster of Phillips Petroleum Co. told the commission he felt it had the responsibility of regulating the producers under the Supreme Court decision, but urged that it be done only after "calm and deliberate" consideration. He added that there is nothing in the decision saying the FPC should reduce any producers' price.

Foster declared the producers cannot be regulated by the utility-rate base formula, average-field price, or other general formula. All these imply that reductions should be made in some instances. Only regulation on the basis of value will encourage exploration and development of reserves and sales for interstate commerce.

Foster pointed out that the mere existence of the power of the commission to lower prices is bound to discourage sales in interstate commerce since producers would prefer to sell in intrastate commerce, which is not under FPC control.

Associations' arguments . . . Counsel for the associations pointed out that about half of the gas produced in Texas, Oklahoma, Louisiana, New Mexico, and Kansas is used within the borders of those states, and such sales are not under FPC jurisdiction. If the rates on sales for interstate commerce are fixed below those in the intrastate markets, they warned, it is inevitable that more gas will be sold intrastate and less will go into interstate commerce.

Many producers already are avoiding sales to interstate transporters and are seeking intrastate markets, it was declared. And unless the producer receives sufficient income from his sales to justify the high costs of searching for new reserves, there will not be enough new discoveries made to keep the supply equal to the demand.

In addition to accepting present rates, the joint plea also urged the acceptance of escalation, step-up, and favored-nation clauses which are the producers' protection against the long-term upward trend in prices.

The associations argued that until the Natural Gas Act is amended the commission should:

. . . **Accept contracts** which the commission is satisfied were entered into under competitive conditions or are in line with competitive prices.

. . . **Hold that increases** in the price of gas under the pricing clauses of the contracts will not be considered as changes in rates.

. . . **Consider complaints** against producers' prices in the light of the conditions surrounding the execution of the contract and other factors pertinent to the sale.

Other arguments . . . Banks, insurance companies and other lending and investment agencies have a direct interest in federal regulation of natural gas

New Kermac Units on Stream

New U.O.P. fluid-catalytic cracker and polymerization unit at Kerr-McGee Oil Industries, Inc., refinery at Wynnewood, Okla., went on stream last week to wind up an extensive expansion and modernization program for the refinery. The new cracker has a design capacity of 5,650 bbl. daily and will process a mixture of southern Oklahoma crudes. The poly unit has a capacity of 500 bbl. daily. The construction program included revamping the crude unit to increase capacity from 8,500 bbl. to 15,000 bbl. daily. Refinery Engineering Co., Tulsa, did construction work.

producers, representatives of those interests declared. In addition to supporting the industry's plea for a minimum of regulation, they also held it important that the regulation not be retroactive.

There was no indication just how deeply the financial interests are involved in the industry, but in a brief filed with the commission, Prudential Insurance Co. revealed it had $237,000,000 invested in natural-gas pipelines and $49,000,000 invested in natural-gas production.

Gas Bill Submitted

Measure calls for end of FPC control over producers

WASHINGTON. — The industry's fight to amend the Natural Gas Act to free independent producers from Federal Power Commission control was launched in Congress last week.

Rep. Frank Ikard of Texas kicked off the battle by introducing a bill abolishing the FPC's rule over gas producers. Several similar bills are expected to be introduced.

In presenting his bill, Ikard pointed out the production of oil and gas go hand-in-hand, adding that it "certainly seems reasonable to assume" that the next step of the Government would be grabbing control of oil production.

Ikard told the House that the commission's order freezing gas prices at the well head has practically stopped the industry's expansion, and many producers have ceased to offer gas for sale in interstate commerce.

The Texas congressman said gas producers are not going on a "sit-down strike," but are forced by "simple, economic, and practical fact" not to commit gas to long-term contracts when they can't forecast what price the FPC will allow them. He said producers also cannot complete their financing without telling bankers at what prices their gas will sell.

In regard to exploration, Ikard said: "I doubt if even the greatest advocate of federal control of the gas industry would venture a prediction that even an all-powerful federal Government could force anyone to hunt and explore for gas when the price of that product is unknown and undetermined."

Industry committee ready . . . The General Gas Committee, which will develop the strategy for the fight for legislation from offices opened in Washington this month, has perfected its organization with Maston Nixon, Corpus Christi, Tex., as chairman.

A steering committee has been appointed with R. F. Windfohr, Fort

WATCHING WASHINGTON

Bertram F. Linz

Capitol Hill is Off

More than a score of bills directly affecting the oil and gas industry were introduced in the opening days of the new Congress.

A run-down of the measures introduced shows the many phases of the oil industry in which Congress is interested.

Thirty senators signed a bill introduced by Sen. Estes Kefauver of Tennessee to whittle the good-faith defense against charges of price discrimination in violation of the Robinson-Patman Act approved by the courts in the Standard Oil Co. (Ind.) "Detroit" case. Similar legislation was introduced in the House by Rep. Wright Patman of Texas.

Declaring that this is a "glaring loophole" in the law, Kefauver said proving discrimination is not in good faith "is almost impossible as a practical matter."

The Kefauver-Patman bill would recognize good faith as a defense "where only an individual competitor, or individual competitors, as distinct from competition, were injured," Kefauver said, but it would not be a complete defense where the discrimination might injure competition.

An import quota on residual-fuel oil was proposed in a number of bills introduced by the Pennsylvania delegation. An import quota on oil is expected to be pressed by Rep. Richard M. Simpson when extension of the Reciprocal Trade Agreements Act comes up before the House ways and means committee.

Legislation establishing a pattern of emergency allocations and priorities on fuels in the event of war was introduced by Rep. Abraham J. Multer of New York.

Extension of the Interstate Oil Compact will come up during the session and may be attacked by Rep. John W. Heselton of Massachusetts, who has introduced a bill to amend the agreement to limit the commission's authority.

Heselton also has introduced several natural-gas bills. One would require reports from the Federal Power Commission on the effect and operation of state compacts dealing with the conservation, production, transportation or distribution of natural gas. Another would authorize the FPC to prescribe safety regulations for natural-gas companies.

Competitive bidding for oil and gas leases on lands not within any known structure of a producing oil or gas field is proposed in a bill introduced by Sen. John J. Williams of Delaware. Another bill dealing with the public lands, introduced by Rep. Clair Engle of California, would open lands reserved for power development to mineral leasing.

The first bill to be listed in the House was introduced by Rep. Jere Cooper of Tennessee, chairman of the Ways and Means Committee, to extend the Reciprocal Trade Agreements Act. Later, Rep. James E. Van Zant of Pennsylvania put in a bill providing for a flexible system of adjusting tariff rates to regulate the flow of imports on a basis of fair competition with domestic products.

Highways and Taxes

President Eisenhower's proposals for a $101-billion highway-construction program will be laid before Congress January 27, and there is little doubt that it will meet opposition.

The oil industry is interested because more highways should lead to higher gasoline sales, but there is another aspect involved—the bonds which would be issued to finance the highways would be serviced with money raised by the federal taxes on gasoline and lubricating oil.

This could mean that these levies will never be wiped off the books. They are good for about $1 billion a year and can be expected to increase steadily, particularly if the President's program is endorsed.

A lot of congressmen are scared by the big price the President is putting on the program, even though it is spread over 10 years. They don't like to hear an appeal for economy in Government because the budget can't be balanced and then be asked to approve heavy expenditures even though they will be financed by a new lending agency which would sell the bonds.

Congress may go along with the President's program, but right now it seems probable it will be substantially trimmed.

Worth, Tex., independent operator, as chairman. Subcommittees and the chairmen are: Cooperation with other groups, S. B. Irelan, Cities Service Oil Co., Bartlesville, Okla.; legal, Clayton Orn, Ohio Oil Co., Findlay, Ohio; legislative, Claud C. Wild, Jr., Washington; evidence, Clayton Orn.

Charles E. Simons of the Texas Mid-Continent Oil and Gas Association, Dallas, was named committee secretary, and Guy M. Woodward, Tulsa, will work with the Washington office.

Offshore Sale Set

March opening announced for submerged land bids

WASHINGTON.—The Bureau of Land Management is preparing to call for nominations for its third sale of oil and gas leases on the outer Continental Shelf.

Official announcement of the sale may be made this week, with the opening of bids set for some time in March.

It is expected that in addition to the areas nominated by prospective bidders that some or all of the nine tracts off Louisiana which Kerr-McGee Oil Industries, Inc., bid on in error at the October 13 sale will be reoffered. The company was the only bidder on seven of the tracts, but there were several offers for the other two.

At the October opening the bureau sold 88 tracts out of 180 put up for bids after 19 tracts originally listed were withdrawn because they were within the area claimed by Louisiana. An opening of bids for leases off the Texas coast resulted in the sale of 19 of the 38 tracts offered, one on a record-breaking offer of $2,209 per acre. The Government secured approximately $140,000,000 in bonuses from the two.

Tariffs May Be Cut

President asks Congress to extend Trade Act 3 years

WASHINGTON. — A 3-year extension of the Trade Agreements Act, with authority to make further cuts of 15 per cent in tariffs during that period, was asked of Congress last week by President Eisenhower.

The President's program came as no surprise, since he asked for the same thing last year but had to settle for a 1-year extension.

Legislation proposing the extension already has been introduced by Rep. Cooper of Tennessee, chairman of the House Ways and Means Committee, and is scheduled to come up before Cooper's committee when it is organized.

In his second message of the year, Eisenhower told Congress he intends to submit the General Agreement on Tariffs and Trade for Senate approval after it has been revised at an international conference under way in Geneva, Switzerland. This is the agreement under which trade agreements have been made since the war, but the United States, while participating in the program, has never formally joined.

Foreign investments . . . The President also told Congress he would ask later in the year for approval of U. S. membership in a proposed International Finance Corp., which will make loans without government guarantees for private investment in less-developed areas.

The President closed his remarks about foreign investments by pointing out that "it must be recognized that when American private capital moves abroad it properly expects to bring home its fair reward. This can only be accomplished in the last analysis by our willingness to purchase more goods and services from abroad in order to provide the dollars for these growing remittances."

The last sentence was viewed by some as the administration's answer to suggestions of placing quota restrictions on oil imports, a point on which the Cabinet Committee on Energy Supplies and Resources Policy reportedly is split.

WEST COAST

Record Hole Dry

Ohio abandons deepest well in world after 1,175 days

BAKERSFIELD.—The world's deepest well, the 21,482-ft. exploratory test drilled by Ohio Oil Co. in the Paloma field 15 miles southwest of here, has passed from the active list to statistical records.

Spudded October 10, 1951, Ohio K.C.L.-A was abandoned January 10, 1,175 days later. While final costs of the well have not been announced, the company probably spent more than $2,000,000 in seeking deeper Eocene pays.

After an extensive fishing job resulted in recovery of stuck drill pipe from a depth of about 12,000 ft. to 17,300 ft., a string of 5½-in. casing was set at 17,222 ft. Prospective pays were tested last summer, but all proved noncommercial. Last October the big company rig used to drill the test was moved out and the well temporarily suspended.

When work was resumed with a work-over rig last November, shows at intervals between 11,500 ft. and 13,115 ft. were tested without success. Following pulling of the 17,222 ft. string of 5½-in. casing, shows above the 10,000-ft. Stevens pay were tested.

Trans Mountain Expanding

BELLINGHAM, Wash. — Trans Mountain Pipe Line Co. has announced it will build 36 miles of new line in March to supply Shell Oil Co.'s new 50,000-bbl. per day refinery under construction at Anacortes, Wash.

Engineers Limited Pipeline Co. has the contract to lay the line, which will consist of 27 miles of 20-in. from Laurel to Burlington and 9 miles of 16-in. lateral line to be connected to Shell Oil Co.'s new refinery at Anacortes.

Work on the $2,750,000 job will start in the spring and be completed in mid-summer about the same time the first units of the Anacortes refinery are scheduled to come on stream.

Airport Field Output Cut

LONG BEACH.—Operators in the Airport field on the northeast flank of Signal Hill voluntarily have further pinched back the prolific producers completed in a thick 8,600-ft. Miocene sand. Output of 17 completed wells last week was approximately 13,100 bbl. daily, with maximum production of most wells being held to about 750 bbl. daily.

Peak output of the new field, discovered by The Texas Co. last year, was established January 5. At that time, with 15 wells producing, output reached almost 15,000 bbl. daily. Several wells had initial outputs in excess of 2,500 bbl. daily and flowed about 1,800 bbl. daily for a few days. Before the recent cutback, however, voluntary limit for most wells was about 1,000 bbl. daily.

Texaco, with six producers, is the only major company in the field. Hancock Oil Co., jointly with Union Oil Co. and General Petroleum Corp., has five wells. Termo Oil Co. has four producers.

Offshore Bills Introduced

SACRAMENTO.—First bills opening submerged lands offshore from California to more widespread drilling were introduced here last week by Sen. James Cunningham.

The bills, if passed, would liberalize the state leasing laws. The present laws specify drainage of state lands must occur before a drilling permit will be issued.

GULF COAST

L.P.G. Line Started

System will move products from Texas gasoline plant

CORPUS CHRISTI.—Products Pipe Line Co. has let contract to Panama-Williams Co., Houston, for construction of about 90 miles of 5½-in. L.P.G. line from Wilcox gasoline plant in Lavaca County to Texas City, Tex.

Products Pipe Line is a newly formed affiliate of Goliad Corp., which in turn is affiliated with the Harry W. Bass organization of Dallas.

Work on the new line is under way at river crossings along the route, and actual line laying is expected to start within 60 days. Construction is scheduled for completion by mid-summer.

The line will transport butane, propane, and natural gasoline from the Wilcox plant to Texas City where the products will be marketed locally, according to C. T. Wells, Jr., vice president of Products Pipe Line. Wells declined to comment on capacity of the line or initial throughput.

The Wilcox plant, completed last May to process gas going into the new Wilcox Trend Gathering System in which the Bass organization has an interest, has a gas-processing capacity of 200,000,000 cu. ft. daily. The system gathers and sells gas to Texas Eastern Transmission Corp. for delivery to eastern markets.

Products Pipe Line, which is headed by Harry Bass as president, recently received permission from the Defense Production Administration for quick tax write-off of 40 per cent of $126,000 and 25 per cent of $1,781,000 for construction of the new line.

Humble Leases New Barge

HOUSTON. — American Tidelands, Inc., has leased its nearly completed submersible drilling barge to Humble Oil & Refining Co.

Alexander Shipyards in New Orleans is building the barge and expects to have it ready for trial runs within 2 weeks. Humble's only previous offshore experience has been drilling core tests from a De Long barge.

The barge is capable of making hole in 45 ft. of water. It is 200 ft. long, 74 ft. wide, and 12 ft. deep. A 2,000-hp. diesel-electric drilling rig is mounted on the barge so it can be towed as one unit.

The barge is similar to one constructed by Alexander for Ocean Drilling & Exploration Co. last spring; however, the drilling equipment in American's unit is mounted in the upper hull instead of the lower hull.

Humble will pay a daily rental fee for use of the barge. The company will use the barge off Grand Isle, La.

Gulf Plans Units

Construction scheduled in '56 at Port Arthur refinery

PORT ARTHUR.—Gulf Oil Corp. plans to add 82,500 bbl. per stream day to the atmospheric-distillation capacity of its refinery here during 1956.

The new facilities will probably replace combination cracking units that currently process 82,500 bbl. of crude daily. The capacity of the refinery is 271,900 bbl. daily.

In addition to the atmospheric distillation units, Gulf also plans to increase the refinery's fluid catalytic-cracking capacity 60,000 bbl. daily and the vacuum-distillation capacity 33,300 bbl. daily. These increases also are planned in 1956.

Gulf's refinery here, third largest in the nation, currently has an atmospheric-distillation capacity of 189,400 bbl. The new facilities would increase this figure to 271,900 bbl., current capacity of the plant.

The 1956 construction program will double the size of the fluid catalytic-cracking capacity and will increase the vacuum-distillation by 50 per cent.

Big Conroe Well Completed

CONROE, Tex.—Conroe's townsite field reported its sixteenth and biggest oil well last week.

Humble Oil & Refining Co., major operator in the field which was discovered a year ago, brought in Well 77 for a flow of 372 bbl. of oil daily, on a dual completion.

The well is producing from 5,150-56 ft., and 5,289-5,306 ft. A flow of 144 bbl. came from upper perforations and 228 bbl. from the lower horizon. This is the first dual completion in the eastern part of the city, and Humble plans to drill five more directional holes in the area shortly *(The Oil and Gas Journal, December 27, 1954, page 115).*

Pipelines Still Planned

HOUSTON.—Houston Texas Gas & Oil Co. last week was "getting close" to the Federal Power Commission with its bid to build two 30-in. natural-gas pipelines, but when is still the question.

The company revealed plans last March to lay a 30-in. line from East Texas to Duluth, Minn., via Chicago and another 30-in. line from South Louisiana to New York, detouring through Florida. J. O. Mack, president of the firm, said at that time he'd go before the FPC within 90 days with plans for one of the lines *(The Oil and Gas Journal, March 8, 1954, page 60).*

Last week, Mack said, "We're getting pretty close to going before FPC, but I can't tell you exactly when."

The two projects would cost more than $337,000,000 and Mack says he has "plenty of gas and plenty of markets."

CANADA

Imperial Cuts Crude Prices

CALGARY.—Imperial Oil, Ltd., has cut the price of Alberta, Saskatchewan, and Manitoba light-gravity crudes 7 cents a barrel as result of lower prices for crudes available in Ontario.

The new field prices posted for Alberta crudes are Redwater, $2.48½; Leduc-Woodbend, $2.59½; Golden Spike-Acheson-Stoney Plain, $2.53½; Excelsior, $2.49; and Turner Valley, (41°-gravity) $2.82½. The Saskatchewan prices, posted for Viking crude, are Smiley, $2.24, and Eureka, $2,36. The Manitoba postings for Mississippian crude are Daly area, $2.54, and Virden area, $2.45.

Pembina Field Extended

CALGARY. — Production in the Pembina field of Alberta has been extended ½ mile to the southwest by Stanolind Oil & Gas Co. and Hudson's Bay Oil & Gas Co., Ltd.

Their 9 Pembina Crown "F" flowed 60 bbl. of 36.9°-gravity oil in 2¼ hours through 48/64-in. choke for a calculated potential of 575 bbl. daily.

Manitoba Wildcat Completed

VIRDEN, Man.—California Standard Co. has completed its Cal-Standard South Regent wildcat in the southwestern corner of Manitoba as a Mississippian light-gravity producer. Results of production tests have not been released.

The well was drilled to a total depth of 2,824 ft. in the Mississippian and plugged back to 2,514 ft.

The discovery is 5 miles north of the Whitewater Mississippian field and 4½ miles west by south of the British American-Union Croll 4-13 abandonment.

Delhi and Taylor Merge

New company formed by Texas firms will be an integrated oil organization with assets of approximately $80,000,000

DALLAS.—Final papers were signed here last week for the merger of Taylor Oil & Gas Co., of Taylor, Tex., and Delhi Oil Corp., Dallas, after stockholders of both firms approved the proposal earlier in the week.

The new $80,000,000 firm is Delhi-Taylor Oil Co. Delhi-Taylor, as of February 1 when the merger goes into effect, will own estimated net proved reserves of 47,306,000 bbl. of crude oil and condensate and 2,255 billion cubic feet of natural gas.

It will take over 427 net oil wells and 110 net gassers on 136,602 net proved acres of oil and gas leases in Texas, New Mexico, Louisiana, Kansas, Oklahoma, and Wyoming. The new firm will hold more than 750,000 acres of wildcat leases in Texas, Arkansas, California, Colorado, Kansas, Louisiana, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Utah, and Wyoming.

Delhi-Taylor also will take over operation of Taylor's 40,000-bbl. refinery at Corpus Christi and the one-half interest of the latter in a 12,000-bbl. plant at Port Isabel, Tex. The Port Isabel refinery was owned jointly by Taylor and Mayfair Minerals, Inc., of McAllen, Tex., with Taylor acting as operator.

It is generally conceded that Taylor's possession of the refineries made the merger highly desirable to Delhi, which is a producer only. Conversely, Taylor found it favorable from one standpoint as providing an additional source of crude for the refineries. Much of the oil charge for these plants currently is purchased by other firms.

Big loan negotiated . . . A co-feature of the merger was the negotiation by officers of Delhi-Taylor of a 15-year $51,500,000 loan which will be used to retire outstanding obligations of both companies and to provide working capital for Delhi-Taylor. Roughly $45,000,000 is slated for meeting the combined debt.

New York Life Insurance Co. and Mutual Life Insurance Co. of New York are subscribing $15,450,000 of the loan. The remainder is being handled by four banks: Republic National, Dallas; Society for Savings, Cleveland; Chase National, New York; and Chemical Corn Exchange Bank of New York.

Officers . . . Delhi-Taylor will be headed as president by James L. Sewell, former president of Taylor. Clint W. Murchison, former president of Delhi, will be chairman of the board, and Phil T. Bee, former executive vice president of Delhi, will be vice president.

Terms of merger . . . Delhi-Taylor will have outstanding 5,363,097 shares of common stock. Based on latest quotations for Delhi stock, which will be exchanged for Delhi-Taylor stock on a share-for-share basis, this would make the stock worth more than $80,000,000.

Taylor stockholders will turn in their shares on the basis of 1 share of Taylor for 1.37 shares of Delhi-Taylor.

Refineries . . . The Taylor refinery at Corpus is a modern, well-integrated installation its facilities include: Two crude-distillation units with a total capacity of 40,000 bbl. daily; a 10,250-bbl. T.C.C. unit and a catalytic-polymerization unit both placed in operation in December 1951; a 6,000-bbl. Platforming unit completed in August 1953; and a viscosity breaker. The Platformer is designed to produce aromatic concentrates as well as high-grade gasoline.

The Port Isabel plant has a 12,000-bbl. distillation unit and a 4,000-bbl. Platformer.

Record Threatened

Hunt may set deep-drilling figure for Texas this week

DALLAS.—The newly established Texas deep-drilling mark of 18,609 ft. may go by the boards this week.

Hunt Oil Co., Dallas, at midweek had reached 18,536 ft. at its 47 Elsinore Royalty Co. in the little-tested area about 18 miles southwest of Fort Stockton in West Texas' Pecos County.

The Hunt deep test at last report was conditioning mud to run electric log to total depth. The well is believed to be in the Ellenburger, its projected destination. During the previous few days, efforts had been made to restore circulation lost while cutting a core from 18,518 to 18,536 ft. It was hoped to fix top of the Ellenburger with the aid of the electric log.

If the 47 Elsinore is in the Ellenburger, it will have encountered it several thousand feet deeper than it has ever been found before. Deepest known Ellenburger contact was at 15,010 ft. in Phillips Petroleum Co. 1 Ada Price, also in Pecos County. Nearest Ellenburger production is roughly 30 miles east of Puckett field. The formation here produces gas at a depth of about 15,000 ft.

The Texas depth record was set only last September by Gulf Oil Corp. at its ill-fated 1 P. G. Northrup about 30 miles north and west of the 47 Elsinore. The 1 Northrup has been temporarily abandoned after being plugged back to 11,200 ft. At its deepest point of penetration, this well was believed to have been in the Mississippian *(The Oil and Gas Journal, December 20, 1954, page 68).*

The 47 Elsinore is located in Section 21, Block B, GC&SF Survey on a 145,000-acre lease block assembled by Hunt in the area.

Fast drilling . . . Drilling of the test, with a rig owned and operated by Penrod Drilling Co., Shreveport, has been exceptionally fast. Top of the hole was an old well plugged and abandoned at 2,000 ft. Hunt reentered the hole February 1 and reamed down to 2,000 ft. Drilling began April 30 from that depth. The lower 16,536 ft. of hole was drilled in only 253 days to January 7 when lost circulation halted drilling. There have been no fishing jobs.

If the 47 Elsinore fails to crack the Texas depth record, Hunt will still have another shot at that mark.

Surface pipe was being set last week at the company's 48 Elsinore Royalty Co., a projected 18,000-ft. test 13 miles southeast of the 47 on the same lease block in Pecos County.

Oklahoma producers begin . . .

Fight for Crude Market

Henry D. Ralph

TULSA. — A campaign to increase production and sale of Oklahoma's crude oil has been started by the state's new governor and a group of independent producers.

Contending that Oklahoma's production has been curtailed unfairly by market-demand proration dictated by purchasers more interested in crude from other areas, they propose legislation for:

. . . **A 25-bbl. minimum allowable** per well per day.

. . . **A common-purchaser law** "with teeth" to require pipelines and other buyers to purchase all legally produced oil offered them.

Imports of foreign oil are the chief target of this campaign, but other states are in the line of fire also. The producers say that Texas, the Rockies, and other areas have taken away a large part of Oklahoma's rightful markets in the Mid-Continent, and they intend to get it back.

The possibility of a cut in the price of crude is openly admitted by the producers, but they insist that they would be better off with higher production at a lower price per barrel than to continue under severe proration at the present price level.

Governor's program . . . Gov. Raymond Gary triggered the campaign January 11 in his first biennial legislative message. He displayed to the legislature a chart showing that Oklahoma's crude production has remained about the same as it was in 1935 while the national demand for crude and the production of the Mid-Continent region as a whole both increased by 2½ to 3 times.

The governor's cue was made the theme of the first general meeting of the newly-formed Oklahoma Independent Petroleum Association, held in Tulsa the same day.

The governor's chart and others were displayed to show that Oklahoma has the capacity to produce much more oil than has been permitted under recent proration schedules, and that its output has been proportionately lower than that of other areas as measured by various yardsticks.

In his legislative message, Governor Gary cited declining employment in and taxes collected from the state's oil industry. He pointed with pride to his action last month in inducing the Oklahoma Corporation Commission to raise the January allowables by 50,000 bbl. per day on the theory that market demand exists because 27 per cent of the oil refined in the state originates elsewhere.

He told the legislature:

"In an effort to solve this most important problem, certain bills will be presented for your consideration. I invite your earnest study of these bills, and I feel certain that a solution can be found by this body which will again restore to Oklahoma its rightful share of the market for oil in the United States, thus keeping the oil industry of Oklahoma on a sound financial basis."

Commission Calls Halt

Revision of conservation regulations has been postponed indefinitely by the Oklahoma Corporation Commission because of disagreement among producers over proration and other features.

Two sets of proposed new regulations were scheduled for public hearings January 12 but when the docket was called the commission dismissed the entire proceeding.

One set had been prepared by a broad committee of the industry appointed by the commission nearly a year ago and was designed to tighten the proration system and modernize many other features of all conservation regulations. The other proposal was presented by an independent group of small producers and was designed to insure higher minimum allowables than those provided by the draft of the industry committee.

What these "certain bills" will be was made plain at the O.I.P.A. meeting that evening, where the producers demanded bigger over-all allowables for the state, revision of the proration system to give a greater share of the output to the smaller and shallower wells, and restrictions on the ability of pipelines and purchasers to establish limits on market demand or to institute pipeline proration.

"We have been sold a bill of goods by purchasers and regulators," R. E. Minnis, Jr., Oklahoma City consulting geologist, said. "We have been told that we must curtail output to prevent disruption of the market, but at the same time the purchasers have been boycotting Oklahoma crude. We have been dividing less and less production among more and more producers, and meanwhile capital is being driven out of the state.

He said a cut in crude price wouldn't be the worst thing that could happen to Oklahoma producers, and pointed out that lower allowables have shrunk operator income more than a lower crude price and more production would.

"We must remember," he said, "that importing companies are sellers of crude, not buyers, though they appear at our market-demand hearings in the guise of buyers."

Showdown . . . Sam J. Rhoades of Fordee-Rhoades Oil Co., Tulsa, said an import "showdown" is here.

He pointed out that Texas, New Mexico, Louisiana, and Oklahoma have boosted January runs more than 400,000 bbl. daily. The importers, he said, will increase first quarter imports in 1955 by another 100,000 bbl. daily.

"The end of January will see idle crude storage bursting at its seams and then one of two things will happen," he declared. "Either the states . . . must retract and reduce allowables, or the importers must curtail and reduce imports. . . ."

He admitted freely that the industry is taking a "calculated risk" that could result in a break in crude prices, but added he thinks the logical place for the market "to be stabilized" will be a reduction by the importers.

Not a wake . . . "We did not form this association to preside over the liquidation of the domestic oil industry," declared W. A. (Gus) Delaney, Jr., independent producer from Ada. He urged support of Governor Gary's proposed legislation to increase the state's output, and concluded:

"The oil industry of Oklahoma has been under the control of the pipelines and purchasers for 20 years. How long are we going to stand for it?"

A more cautious attitude was taken by Paul Shultz, president of Blackwell Oil & Gas Co., Tulsa. He told the O.I.P.A. meeting that a price cut will not stop imports unless the price drops to $1.25 per barrel, and said that building new markets for Oklahoma crude is a difficult and complicated problem and should be given careful and thorough study.

Pemex Unveils New Plant

Wide variety of facilities are included in new lube-oil and wax works; company is pushing several other projects

John C. Reidel

ANOTHER important kilometer post on the road of progress for Mexico's expanding oil industry was reached here last week.

This was the dedication of Petroleos Mexicanos' large lubricating-oil and wax plant in the Antonio J. Amor refinery at Salamanca. Dedication ceremonies, attended by President Adolfo Ruiz Cortines, marked the completion of these facilities:

. . . **High-vacuum distillation unit** with design capacity of close to 15,000 bbl. per day. A new desalter unit has also been installed.

. . . **Two-stage propane deasphalting** unit with two-level recovery system. Design capacity is 5,600 bbl. per std. day of vacuum residuals.

. . . **Two-stage furfural solvent extraction** designed to make spindle, light, neutral, neutral, propane 50, and propane fraction 250 stocks.

. . . **M.E.K.-toluene solvent dewaxing plant** with complete products and solvent-recovery systems.

. . . **Vacuum rerun unit** to rerun stocks for special products.

. . . **Clay-contacting unit** for lubricating oil.

. . . **Wax treating (percolation) unit** designed to handle 895 bbl. or nearly 135 tons per calendar day of wax.

This includes wax shipped in from Tampico. Provision has been made for production of eight grades of wax.

The Salamanca lube-oil and wax plant is unique in the combination and complete processing which is provided and the high degree of instrumentation. A total of 140 instruments is employed in the wax plant alone. Extensive use is made here of cascade (interconnected) control.

What is involved . . . Wax processing at Salamanca embodies these main activities: receipt and blending of solvents, charge-oil chilling, continuous dewaxing (primary) filtration, primary wax-mix chilling, wax fractionation (secondary) filtration, repulp filtration, solvent chilling, products recovery of hard and soft wax and dewaxed oil, solvent recovery, flue-gas generation and chilling of inert gas, and propane refrigeration.

This impressive listing of wax-plant sections still does not convey the complexity of flow and process details involved in this type of refinery operations. Petroleos Mexicanos engineers have done an excellent job in mastering the overall processing as well as many details involved in the construction and operation of this plant.

Salamanca refinery . . . The refinery went on stream in 1950. It was built to meet increased demands in the Central Zone of Mexico for motor, tractor, and railroad fuel. Installations originally included atmospheric-crude distillation, Dubbs thermal cracking and gas concentration plant, Perco catalytic-desulfurization and treating, and blending facilities.

Addition of the new high-vacuum unit raises throughput capacity of the refinery from 30,000 to 40,000 bbl. per day. Design of the vacuum unit calls for operation on 14,700 bbl. per day of topped crude. The crude-oil charge to the refinery is made up largely of Poza Rica production with some Tenixtepec crude oil.

While pausing briefly to dedicate its new Salamanca facilities, Petroleos Mexicanos, under the energetic direction of General Manager Antonio J. Bermudez, is also very active in other areas.

Refining . . . A T.C.C. unit, crude-distillation unit, catalytic-polymerization plant, and associated facilities are under construction at the Minatitlan refinery. The existing distillation facilities are being revamped and two crude desalters being added. The T.C.C. unit will have a capacity of 10,000 bbl. per day of fresh liquid and vapor feed and 5,000 bbl. per day of recycle. These facilities are being built under contract with the Fluor Corp.

Plans also have been completed for construction of a Model IV catalytic-cracking unit at the 18th of March refinery at Atzcapotzalco in the Federal District. New distillation and other facilities are nearing completion under contract with Arthur G. McKee Co. at this refinery.

Gasoline plants . . . Absorption facilities are being doubled at Poza Rica, with new absorbers to handle an addi-

tional 113,000,000 std. cu. ft. per day, A new natural-gasoline plant is under construction just across the border at Reynosa to provide 300,000,000 std. cu. ft. per day of residue gas for sale. Facilities being built at Reynosa under contract with Hudson Engineering Co. will include absorbers, rich oil propanizer-reabsorber, and fractionation train.

The Poza Rica field is operated under a successful pressure-maintenance program, both gas and water being injected for this purpose. Prime purpose for expansion of field processing facilities is to prepare an additional 40,000,000 cu. ft. per day of gas for injection into the field. A new water-treating plant has been installed at Poza Rica to condition Cazones River water for injection into the reservoir.

New fields . . . Pemex has active exploratory and drilling program that has made significant new discoveries. These include the new Miguel Hidalgo and Angostura fields, the Jose Colomo field with its large gas reserve, and the new La Venta area in the Isthmus of Tehuantepec.

New pipeline construction is underway to keep pace with expanding production and new refinery facilities.

In Mexico's young but rapidly expanding economy the petroleum industry is a very important factor. President Cortines recently declared: ". . . We recognize that the petroleum industry is one of the foundations for the social and economic betterment of Mexico." Accordingly, high priority is being given Pemex's many projects.

Egyptian Well Hits

Strike near Wadi Feiran flowing 2,170 bbl. daily

INTERNATIONAL EGYPTIAN OIL CO. has discovered new production in its Belayim 1 well 6 miles south of Wadi Feiran on the Sinai Peninsula of Egypt.

Dr. Hassan Marei, the Egyptian Minister of Commerce, announced in Cairo that the well had tested at a rate of 2,170 bbl. daily at 7,300 ft. He said the crude showed less salt water than the Wadi Feiran production.

The minister's statement indicated the production at Belayim was found in the Eocene about 1,000 ft. below the mid-Miocene formations from which the Wadi Feiran wells produce.

The concession is operated by National Petroleum Co. of Egypt, a subsidiary of International Egyptian. Operations are being handled by Southern California Petroleum Co., Los Angeles, a minority stockholder.

International Egyptian undertook operations in the Wadi Feiran area about two years ago. The original Wadi Feiran discovery was made by Standard Oil Co. of Egypt (Standard Oil Co. [N. J.]), shortly before it abandoned its activities in the country in 1949. Southern California drilled a second productive Wadi Feiran well and began exploratory work near there on three other seismograph prospects, Baba, last reported drilling below 10,200 ft., Sidri, drilling below 5,900 ft., and Belayim.

Majority interest in International Egyptian has been held by a group of Swiss investors. Cie. Financiere des Petroles (Petrofina) recently acquired part interest in the company *(The Oil and Gas Journal, November 22, page 74, and January 3, page 75).*

Red Production Shifting

Bashkir region expected to become Russia's top producing area; nation's output grows, but '55 goal may not be hit

Dahl M. Duff

RUSSIAN crude production in the Bashkir region between the Volga River and the Ural Mountains will become the No. 1 Soviet source of oil in another year or two if the present rate of growth continues.

A recent article in the Russian publication, Pravda, reported that production from the Bashkir region, the so-called second Baker, rose from some 40,000 bbl. daily (2,000,000 metric tons) in 1940 to around 300,000 bbl. daily (15,000,000 metric tons) at present. Last year's production represented a 20 per cent increase over 1952 and was double 1950.

Another gain of around 20 per cent is planned for 1955—which would bring the region's output to about 360,000 bbl. daily (18,000,000 metric tons), or higher than production from the historic Baku area.

The Baku area is believed to be producing between 340,000 and 360,000 bbl. daily (17,000,000 to 18,000,000 metric tons), and Soviet officials have reported that the aim in Baku is to hold output steady without major decline.

Since Russian production for 1954 amounted to 1,140,000 bbl. daily, an estimate based on the Communists' own statements, the Bashkir region's output makes up around 26 per cent of the total. Russian reports indicate that the country's crude output has been rising yearly between 100,000 and 120,000 bbl. daily.

Reaching goal unlikely . . . Although the recent annual increases in total Russian production come to 10 per cent or more, it does not seem likely that the 1955 goal of 70,000,000 metric tons (about 1,400,000 bbl. daily) will be realized. Meeting this target would mean a jump in 1955 of about 22 per cent in total output.

The Pravda article describing the development of Bashkir into a major production area said some of the more recent discoveries had been made in deep Devonian formations which had a productivity equal to the best of the earlier wells. Both new and old fields and pools are undergoing large-scale development work.

Operations criticized . . . The Pravda discussion, which was written by the head of the Bashkir section's Communist party, Semyon D. Ignatiev, contained the usual self-criticism that characterizes most Communist statements. The article said the slowness of drilling and poor utilization of equipment is holding up work.

Transportation difficulties, such as beset other Soviet enterprises, also hinder the Russians in this region. Many sections lack roads, and even on existing ones, movement in the winter becomes impossible.

Other areas . . . Other Soviet disclosures have indicated progress in oil development elsewhere in the country. The first-half 1954 report of the Statistical Administration of the Council of Ministers said oil production had recently started near Stalingrad, scene of the famous World War II German surrender, on the west bank of the Volga. Production also has been found at an unidentified location in between Moscow and Leningrad in northwestern Russia

Some individual segments of the Petroleum industry failed to attain their targets, though the production rise was the planned 10 per cent during the first half, according to this report. The oil industry, which earlier was criticized for having a large bureaucratic organization, was censured for not having reached its planned half-year figure of capital investment and productivity capacity. The industry's technical progress also was said to be unsatisfactory, with the manufacture of petroleum-industry equipment lagging behind plan.

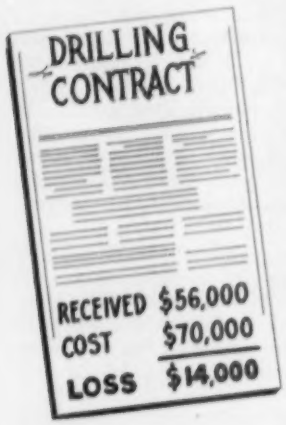
The Year Ahead . . . As Leaders See It

This is the second installment of "What's Ahead in 1955." These are comments by the Journal's all-divisional Editorial Advisory Board. They are contributions by oil and gas industry leaders and are concise appraisals of coming events and developments. Further comments will appear in coming January issues.

Drilling

"Cheap bids" lead to junk equipment

"A subject vital to the drilling contracting industry is the management policies of the major oil companies, concerning competitive bids and drilling prices in general of their contractor rigs. During 1954, there has been a tremendous stress by the management personnel of the major oil companies on their drilling department personnel to encourage lower drilling prices, and to encourage more competitive bids without regard to contractor's equipment, personnel, or future investment.



"This general trend, along with the general economic problems that already face the drilling industry, has dealt a crippling blow to the drilling contractor. This trend is also a reversal from that followed by most major companies which allowed the drilling contracting industry to grow to its present size. For many years, most major companies acknowledged the heavy investment required for bigger and newer drilling rigs, and in doing so, allowed price adjustments and differentials for bigger equipment and better equipment. Today such considerations are not taken into account, and even in many areas, field prices and field work which has always considered a stabilized item so that any contractor could figure in advance on his future investments, have now become a thing of the past.

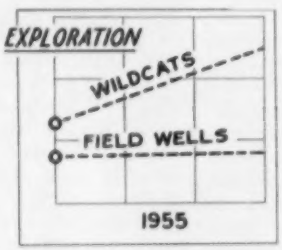
"Most major companies today are requiring competitive bids on each location after a contractor has moved his equipment into the new field and has been drilling for the company on steady field work. This completely destroys any security for that contractor to make future investments on new rigs. He realizes that his present price is probably only good for that well, and that on the next well, not only will he be forced to bid, but in all probability will lose the location. This has caused most contractors to drop completely all depreciation considerations on drilling equipment, which automatically drops future investments in new and modern drilling rigs.

"For years, this general down-grade of contractor's prices and economics has been blamed on the contractors themselves, and we feel that the major oil companies and the management of these companies have had more to do with this problem than any other factor, and that it is not being acknowledged as such throughout the industry."

Exploration

1955 exploratory picture healthy

"Exploration activity appears to be strong for 1955, with a greater number of wildcats indicated than in 1954. This will be a healthy situation for the industry, as it needs to find new reserves. The fact that there is a large reserve producing capacity already developed to meet indicated demand estimates would suggest that development drilling may be at about the same rate as 1954 and possibly could be slightly less to maintain a healthy industry. Such a lag would allow demand to absorb possibly 500,000 bbl. per day producing capacity within the next 2 years.



"Probably the Rocky Mountain states are hoped to be the most prospective for oil and gas discoveries, with the Mid-Continent territory a close second in new reserves in the year ahead. The Texas-Louisiana-Gulf Coast offshore area certainly is the most prospective in the long run, but its development will be slower due to natural reasons. California should not be written off . . ."

Shooting versus slim-hole drilling

"The question has been raised as to the relative success of seismic exploration in contrast to slim-hole drilling. Probably, where seismic records are good and correlation of these records with geological structure is simple, seismic exploration is best; but where records are poor and correlation with the subsurface geology is questionable or unreliable, exploration may perhaps best be undertaken by a grid arrangement of slim holes, properly and economically spaced . . ."

Geologist advises to redetail areas

"We may expect considerable success from the redetailing of old areas. Many of these areas were drilled before we had our modern highly specialized means of drilling and completing wells.

"Additional work in areas more recently brought into production is justified because, in the early part of a campaign of development, the approach is essentially reconnaissance. It is incomplete in coverage and so may miss features of importance. Also, wherever production has been found in shallower formations, deeper testing is warranted provided the deeper formations are sedimentary and of such a nature that they might be favorable to oil or gas accumulation."

"Personnel improvement . . . most important item . . . facing industry"

Personnel

Good men are the No. 1 item

"I speak only with reference to the drilling contracting phase. We have found that the personnel picture on our drilling rigs outweighs all other considerations in our performance and in our drilling to all depths. Therefore, we concentrate most of our time and money in producing the most efficient type of personnel organization available. We have also found that by distributing work to too many employes, rather than assigning each man a large and definite responsible job, we lose a lot of the efficiency and ingenuity of the individual worker. By that we mean a few well-trained, intelligent personnel that can more efficiently and more intelligently handle the large jobs today, rather than a large type organization where ingenuity is replaced by manpower. This can be seen more clearly, and maybe from a more practical viewpoint when you compare the drilling times made in several fields today where we are using different size rigs in the same depth drilling.

"In the Springer drilling in the Purdy trend, of Garvin, McClain, and Grady Counties, Oklahoma, where most of the contract drilling is to 10,000 ft. or the Springer sand, we find rigs which are designed for 5,000-ft. drilling often out drilling our 10,000 to 12,000-ft. size drilling rigs with big pumps, by as much as 33⅓ per cent in drilling time. We can reverse the crews and reverse the percentages equally.

"For this reason, we feel that "personnel improvement" is perhaps the most important item facing, not only our industry, but all industries of 1955. Our basic theme in training our personnel for the coming year is to put more emphasis and stress on the individual, to give him more authority, and to make him less dependent upon other workers and other labor union effects, so that he will think for himself and develop his ingenuity to the extent where he, without hesitation, will apply new ideas in an effort to learn new ways of doing things. In other words, we are trying to break up the mass psychology of lots of manpower rather than the importance of the individual."

Pipeline

Prognostications for products pipelines

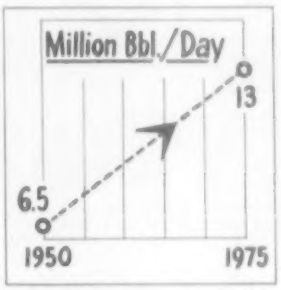
"The year 1955 will see the advent of many new products pipelines to transport finished refinery products, natural gasoline, and liquefied petroleum gases. Many of these lines will extend from the large producing centers to either the northern industrial areas or to the seaboard for transocean or coastwise shipment.

"In addition, some such lines also will be constructed to furnish raw materials to presently operating petrochemical plants, as well as to new plants which will be started in 1955. The last of the government-owned petroleum chemical manufacturing plants will be sold to private industry."

Production

Production volume is forecast

"Recent estimates of total U.S.A. energy consumption indicate that requirements will grow from a level of 35,000 trillion B.t.u. in 1950 to 62,000 trillion B.t.u. in 1975; this means in crude oil equivalent a growth from 16.5 million barrels per day in 1950 to 29 million barrels per day by 1975. Actual oil production (includes natural gas liquids) was 6.5 million barrels per day in 1950, and forecast as 13 million barrels per day in 1975. This means oil demand may double in the 25-year period. During the previous 25 years, the growth was threefold.



"Secondary recovery will continue to be active although a number of the larger projects are well under way at today's economics. Other projects will come along in the future as the posted price of crude increases to justify them. This volume will be significant in daily rates of crude oil production for many years to come.

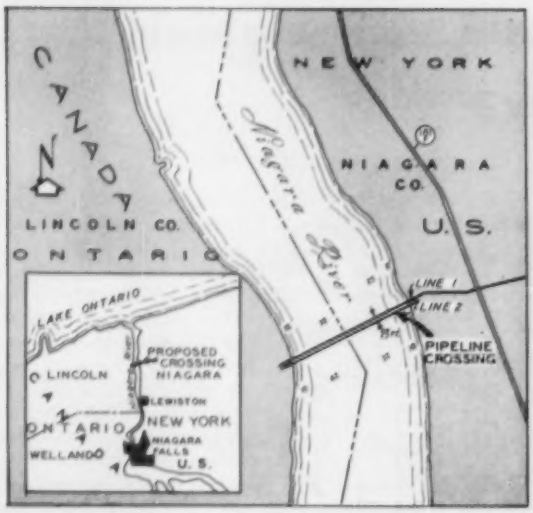
"I would expect a slight increase (200,000 to 250,000) in daily average crude oil production in 1955. Already, Texas-Louisiana, Oklahoma, and Kansas have increased allowables which may hold for the first quarter. Crude oil importers are likely to proceed cautiously in 1955 about increasing imports of crude oil, thereby permitting domestic producers to share in the greater portion of demand growth. If so, this may tend to solve the seriousness and burden of surplus or reserve producing capacity.

"The Rocky Mountain states are just now beginning their big volume stage, and now, with substantial pipeline outlets, will be a disturbing factor unless adequate conservation and market demand laws are enacted shortly. Production from these states should be absorbed into the principal refining centers by stepwise adjustments in supplies from previous supply sources."

Natural Gasoline

Need for automatic, portable-type plants

"There is a definite need of a small automatic and portable type gasoline plant to recover the C3, C4, and natural gasoline components. Consumption of the C3 and C4 components has been steadily increasing at 8 per cent annually. Increasing labor costs make it essential to have more automatic devices and therefore, less employes, to continue profitable operation. If acceptance of this principle became wide spread, we would reduce materially the very wasteful practice of venting casinghead gas during the early stages of . . . an oil pool. Already the chemical industry combining with the younger and more alert gas industry are beginning to capitalize on the recovery of the lighter hydrocarbons which can be transported by pipeline . . . to points of population concentration and industrial centers."



DUAL CROSSINGS of the Niagara, each straight and about 1,900 ft. long, were made to deliver N.G.T.'s gas to Canada.

COMPLETED SECTIONS of pipe for the Niagara crossing are shown ready for pull. The small white marker cans help determine proper placing of pipe.

Here's a resume of problems encountered and techniques used as . . .

T.G.T. Makes Seven River Crossings in '54

by C. B. Porter

SEVEN river crossings—two of which are a study in contrasts—were included in expansion of Tennessee Gas Transmission Co.'s system in 1954. Six of these were on the new Kinder, La.-Portland, Tenn., 576-mile, 30-in. pipeline, while the seventh was the Niagara River crossing which ties in T.G.T. facilities with Niagara Gas Transmission, Ltd.'s Toronto operations.

The Kinder-Portland crossings were of the always-formidable Mississippi from Louisiana to Mississippi, plus the Red, Ouachita, and Boeuf rivers, wholly in Louisiana, and the Tennessee and Cumberland rivers, entirely in Tennessee. The Mississippi River crossing, significantly, marks the third time T.G.T. has crossed that stream.

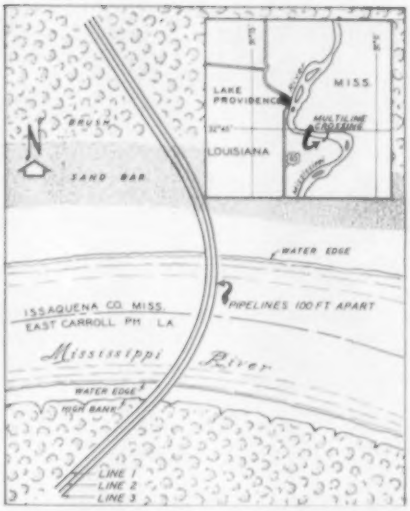
Niagara Crossing

Purpose of the Niagara crossing is to provide a means of delivering Niagara Gas Transmission's gas into the Dominion of Canada. N.G.T. has bought the gas in the Southwest, and T.G.T. acts solely as a carrier, transporting it to the Niagara River and delivering it there to N.G.T. As previously has been noted in the literature, the physical setup is such that with the completion of the Trans-Canada Pipe Lines, Ltd. (transmission system which will tap Alberta gas fields), the flow of gas may possibly be reversed making this Canadian gas available to eastern United States markets.

THE PULLING HEAD and buoy-supported pulling sheave are readied for the first pull. A winch anchored on the Canadian shore made the pull.

The actual crossing was made with two 20-in. lines near the town of Lewiston, N. Y. Two trenches, spaced 25 ft. apart, were dug out of the red-shale river bottom by drilling and shooting. A large, 4½-cu.-yd., clamshell derrick barge, swung on anchors in the swift, 5-ft. per second current, was used in cleaning out the trench to the proposed depth. The minimum requirement in the trench was for the pipe to have a cover of not less than 3 ft. at any point. The cover is a protection against the ice floes that occasionally appear in the river during extreme winter conditions, or other hazards.

Meanwhile, the ½-in.-wall-thickness pipe was being fabricated into 600 to 700-ft. drag sections on the American side of the river. These sections were made up from 40-ft. joints butt-welded together, with all welds being checked by X-ray. Upon making up each sec-



PLAN VIEW of T.G.T.'s Mississippi River crossing shows how the three parallel lines were curved.

IN CONSTRUCTION, this is how the lines were spaced on the Louisiana side. At upper right is the yard where pipe was doubled-jointed.

tion, the pipe was cleaned, primed, double-coated, and wrapped. Following this, an electronic jeep was run over the section to detect any holidays. Dope was removed at such places and replaced to eliminate jeeps. Immediately following this, a rock shield was applied and secured by steel banding material.

Cast-iron weights used . . . As a matter of necessity, 3,400-lb. cast-iron river weights were used and these were secured on 24-ft. centers throughout the 600 to 700-ft. drag sections. Two-by-two lagging was used in between the weights to serve a twofold purpose. First, it was to prevent the weights from slipping should they encounter any jagged edges of rock in the pull through the trench. Secondly, the lagging served to protect the rock shield and pipe during the backfill procedure from possible damage from falling rock. In the actual assembling of the sections, the lagging was installed following the addition of each weight, with the following weight made up snug against the lagging to eliminate any possible play in the weights. Upon inspection following the pulling of the lines, the portion of the pipe which appeared on the far shore showed its lagging to be in excellent condition.

To reduce the negative buoyancy of the pipe, temporary steel buoys having a displacement of 1,779 lb. were attached to the sections on 35-ft. centers. Thus, the pipe with all its appurtenances had its weight reduced to 12 lb. per lineal foot in the trench. These buoys were removed after it was determined that the pipe was in the proper position. The final step in assembling was to weld a pulling head to the end of the No. 1 drag section. Nine sideboom tractors were then used to manipulate each drag section into its proper position to be pulled across the river.

Winch on shore . . . Prior to the actual pulling operation, a winch was anchored on the Canadian shore and a cable laid in the south trench for pulling purposes. Divers then walked through the trench for a final inspection and pulling commenced, with each drag section being lined up and welded to the preceding one as work progressed. The time required to pull the south line was about 8 hours. When the line had been pulled across the river, engineers checked buoys attached at 100-ft. intervals throughout its length to determine the position of the pipe in the trench. These buoys were attached with a predetermined length of wire according to the profile. By noting the amount of excess wire line, it was a simple matter to determine if the pipe was resting in the trench or merely on the river bottom.

The north section of the crossing was pulled in a similar manner. This one was accomplished in less time, a total of about 7 hours elapsing during the pulling operations. Fastest pull on any drag section was 600 ft. in 25 minutes.

Upon completion of the pulling jobs, proper tie-ins were made and carried back to the block valves in the tie-over sections. A pig was blown through the lines from the American side and discharged on the Canadian side, whereupon final tie-ins were made. Lines were then tested with air up to 1,125

CROSSING THE RED RIVER was a sizable project, even though much smaller than the Mississippi and Niagara crossings. Here end of a section has just gone off launching rollers.

psi., with this pressure being maintained for 24 hours without leakage.

The clamshell barge was then used to backfill both trenches, and a fathometer reading taken following backfill procedures.

Mississippi Crossing

In the crossing of the Mississippi River, the methods used varied from those utilized on the Niagara in almost every respect. Three lines of heavy, 1⅛-in.-wall pipe vs. the two lines of ½-in.-wall pipe were laid; the Mississippi lines required no additional weighting; the trench was dredged rather than shot; the pipe was laid from a barge as opposed to pulling; and the three lines were laid in a single trench as opposed to two separate trenches.

Preliminary preparations consumed more than the actual laying of the line. First, the river was surveyed to find a suitable crossing. Conferences with the Corps of Engineers disclosed difficulties to be encountered from scouring and channel shifting. The cost of an underwater crossing was compared with that of building a bridge to carry the lines and estimates showed the multiple-line underwater crossing would cost less than 50 per cent of the bridge cost. Soundings were made at several prospective locations; and with the results in hand, a point 6.5 miles southeast of Lake Providence, La., was selected.

In preparing the site for pipe laying, two 8-yd. draglines were used to remove several hundred thousand yards of sand to prepare the way for the pipe at the river's edge. A dredge was moved in to prepare the trench for the pipe, with the finished ditch being 200 ft. wide at the bottom and the lines spaced 100 ft. apart. The trench depth varied from 80 ft. at the west bank to nil at the center of the main channel.

Pipe laying started in early August. Since it had been decided to install three 18-in. by 1⅛-in.-wall lines, the weight was sufficient without concrete coating. The pipe was cleaned, primed, painted, and double-wrapped in the conventional manner in the pipe yard, with the welding of such heavy pipe taking a proportionately greater than normal amount of time. Eighty-foot sections were welded on the river bank, then transferred to the laying barge in the river as needed. These sections were welded and the joints coated and wrapped, then lowered to the river bed. Usually four 80-ft. sections were laid in a 24-hour period from a laying barge which was 175 ft. long with a 60-ft. beam.

Approach lines . . . River approach lines were 24-in. by ½-in.-wall thickness, coated, wrapped and weighted with a 2⅜-in. thickness of concrete which weighs 226 lb. per ft. The 24-in. weighted pipe was used for the approaches on each side, and the crossing proper consisted of 18-in. lines. Thirty-in. headers were installed so that in case of emergency either of the three underwater lines can be taken out of service.

This was the third separate crossing of the Mississippi by T.G.T. Originally, two 18-in. lines crossed the river via the Greenville bridge. In 1950, the bridge roadway was rebuilt to decrease the total weight, and four 26-in. lines were substituted for the two 18-in. ones. At that time, the company arranged with the city of Greenville to retire the bonded debt on the bridge through rental payments, thereby rendering the bridge toll free to all traffic.

The second crossing occurred in 1951, when two 16-in. lines were laid underwater near the bridge, to handle increased system capacity. Route of the Kinder-Portland line crossed the river some 40 miles downstream from the Greenville bridge, so of course this year's crossing is at that point, about 30 miles above Vicksburg.

Red, Ouachita, and Boeuf Rivers

Crossing of the Red River near Rodgers Landing, Rapides Parish, Louisiana, was accomplished using a combination of the methods on the foregoing two jobs. However, because of its location and size, it was more of a routine job.

Two 24-in., ½-in.-wall pipelines were pulled across the 430-ft., bank-to-bank water crossing after previously having been coated, wrapped, and assembled on shore. Concrete-weighting was applied to these lines to provide the desired negative buoyancy.

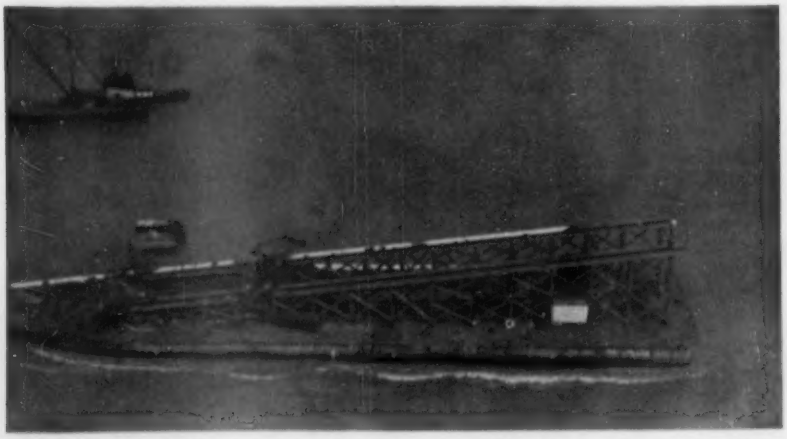
The Ouachita River and its smaller neighboring stream, the Boeuf, and the area between them were crossed with a single 30-in., ½-in.-wall pipeline. The Ouachita was 29 ft. deep and 327 ft. wide, while the Boeuf is a normally shallow stream. Between them lay about 3 miles of lowland, subject to flooding. All the pipe was weighted, with a minimum of 10 ft. of cover obtained over the pipe in the rivers and 4 ft. across the lowlands.

Tennessee River crossing . . . The crossing of the Tennessee River was made in Tennessee, but only a few miles from both Mississippi and Alabama. The crossing consisted of twin 24-in. lines, of ½-in.-wall pipe. The river there is just under 300 yd. wide and is 25 ft. deep. A ditch about 9 ft. deep was shot and dredged, giving a minimum cover of 5 ft. and an average of 7 ft., and the weighted pipe was pulled across.

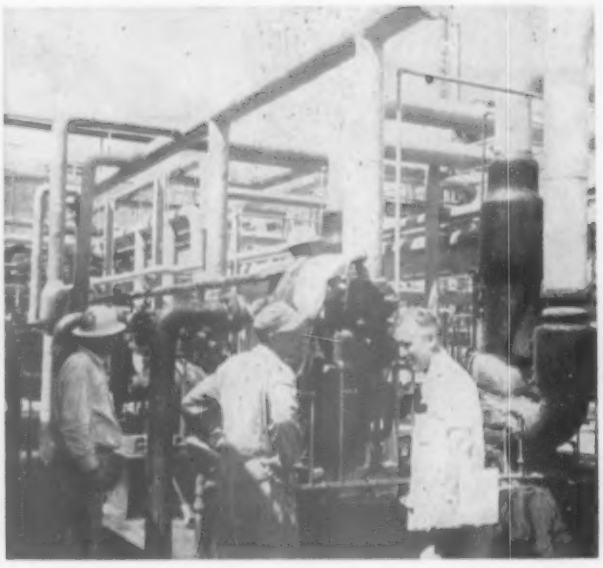
The seventh river, the Cumberland, was crossed a few miles northwest of Nashville, Tenn., as the Kinder-Portland line neared its intersection with the main T.G.T. system. Like the Tennessee, the Cumberland was crossed with twin 24-in. weighted pipelines. The river was 22 ft. deep and 600 ft. wide, with a hard clay and limestone bottom requiring drilling and shooting.

THE AUTHOR

Cecil B. Porter, pipeline superintendent of Tennessee Gas Transmission Co., joined the company as a welding inspector in 1943 and helped construct its original pipeline from South Texas to West Virginia. In 1944 he was made river-crossing inspector, and later that year was named a district superintendent. In 1945 he became assistant pipeline superintendent of the northern division, was appointed division superintendent of the eastern division in 1946, and in 1950 was promoted to his present position.



PIPELAYING for the Mississippi crossing was done from this lay barge. The lines started from the river's north bank and were laid in a downstream catenary.



Accurate Card-Indexed Equipment Records . . .

ENG. No. 10 ENG. SER. NO. 25523 MAKE CLARK MODEL HS-RAB INSTALLED 12 18 50 LOCATION C.H.
COMPRESSORS: SER. NO. 20630 18785 20628 20629 CYL. 29 24 23 19 STROKE 14 TYPE WTH

STACK VALVES

1954	Power Piston Rings (C)	Power Piston Rings (O)	Power Piston Pin Bush.	Power Cyl. Rod Brng. (L)	Power Cyl. Rod Brng. (U)	Main Brngs. (Upper)	Main Brngs. (Lower)	Maintenance Gov. Nor.	Air Start Valves	Scav. Air Valves	Scav. Wiper Pack	Scav. Crosshead Brngs.	Scav. Piston Rod	Scav. Piston Brngs.	Fuel Valves	Air Start Valves Cleared	Spark Plugs	Comp. Cylinder	Comp. Piston Rod	Comp. Piston Brngs.	Comp. Rod Wiper Pack	Comp. Crosshead Brngs.	Comp. Crosshead Pin Brngs.	Comp. Valves
POWER CYL. NO. 1										✓									5	2				
POWER CYL. NO. 2										✓									3	2				
POWER CYL. NO. 3																			3	2				
POWER CYL. NO. 4																			3	2				
POWER CYL. NO. 5																			3	2				
POWER CYL. NO. 6																			3	2				
POWER CYL. NO. 7																			3	2				
POWER CYL. NO. 8																			3	2				
ENG. ACCESSORIES																								
COMP. CYL. NO. 1																								
COMP. CYL. NO. 2																								
COMP. CYL. NO. 3	1/5/54 NEW SET RINGS - THIRD STAGE COMP.																							
COMP. CYL. NO. 4																								

LOCATION: C.H. LAST GEN. OVERHAUL -- J F M A M J J A S O N D 19
ENG. NO: 10 NEXT INSPECTION DUE -- J F M A M J J A S O N D 19

Streamline Plant Maintenance

La Gloria program keyed to master plot plan

by F. Lawrence Resen
Gulf Coast District Editor

A PUMP and driver schedule, a plot plan keyed to show every piece of equipment, and a card index showing the history of the equipment are used to streamline maintenance at La Gloria Oil & Gas Co.'s cycling plant near Falfurrias, South Texas.

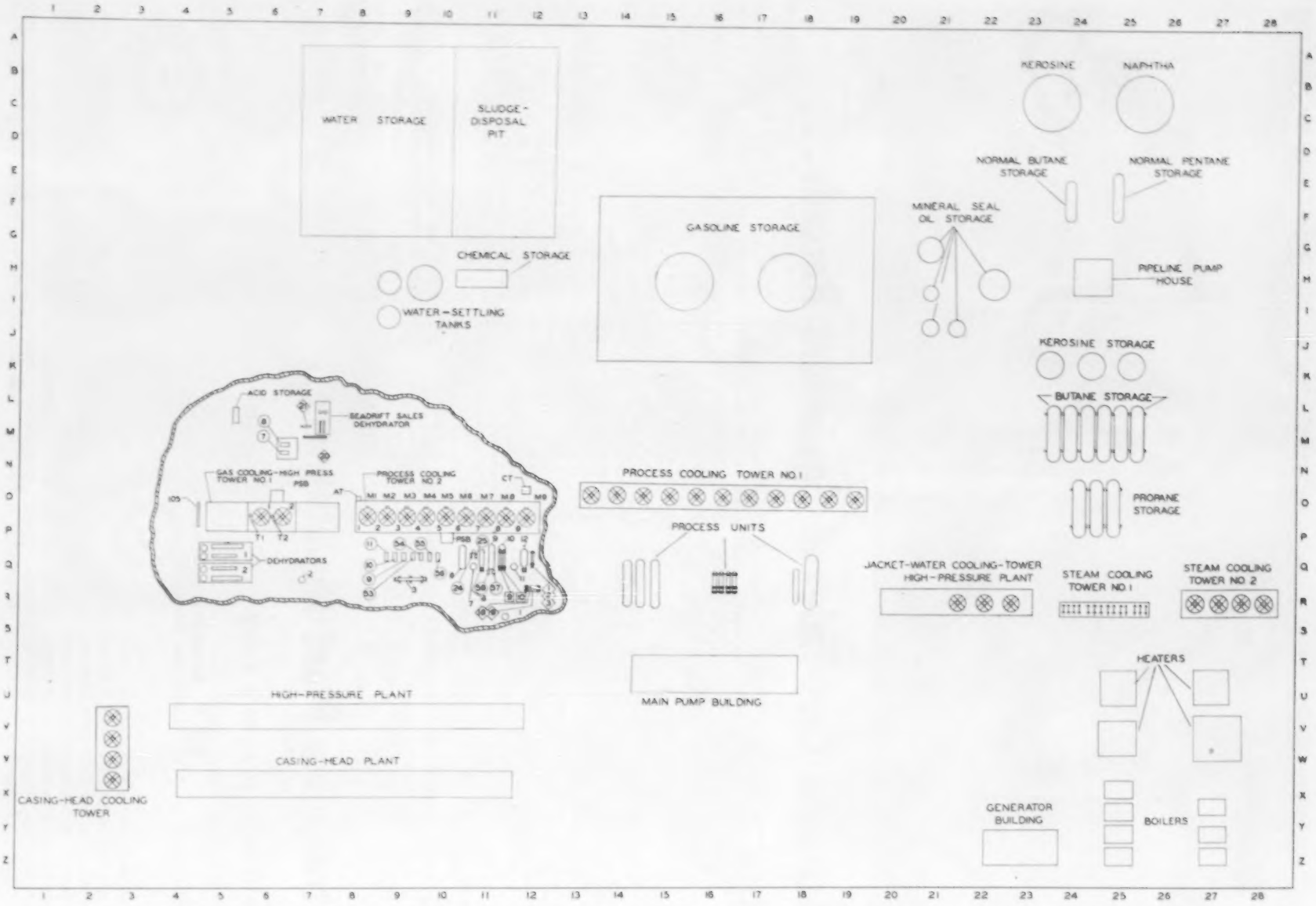
The pump and driver schedule is made up into a handy booklet form, with foldout sheets containing all pertinent data on the various pumps and drivers in the plant. According to Homer Givens, plant superintendent, this schedule is always on his desk and serves as a quick and handy guide in ordering parts, ordering a new pump, or deciding where a spare pump may be utilized most efficiently.

This schedule is only half of a project, however, with the other still in the formulation stage. This calls for the assembling of test curves on all pumps from manufacturer's specifications lists. The curve sheets will also be collected into a booklet to provide additional data on the pumping units at the plant. This will be especially valuable when conditions warrant a change in some phase of plant operations and a study of pump capacities and characteristics is necessary.

Pump and driver schedule . . . Each item on the pump and driver schedule is designed by a code number and location in the plant. Thus, Item 5-A on the pump and driver schedule, No. 7 on the plot plan list of pumps, and located at position N-5 on the plot plan, is the water pump to gas cooling tower No. 1. By crosschecking the location on the plot plan there is then little chance of confusion as to which pump is being discussed.

The pump and driver chart then goes on to show it is a Worthington Type 8L-1, Serial 1066188 pump which has been in service for some time and is therefore classified as "old." Specifications on the pump are then listed such as capacity, head, impeller size, etc. Space is available for the seal number and packing type if these are pertinent.

In like manner, the chart continues with a complete listing of specifica-



Simplified version of La Gloria's master plot plan. Insert at left center shows detail included in original plot.

PARTIAL LIST OF EQUIPMENT SHOWN IN DIAGRAM ABOVE

NO.	TITLE—TURBINES-T	LOC.
1	Fan No. 1—Gas-cooling tower No. 1	O4
2	Fan No. 2—Gas-cooling tower No. 1	O5
3	Fan No. 4—Proc. cooling tower No. 1	O12
4	Fan No. 5—Proc. cooling tower No. 1	O12
5	Fan No. 6—Proc. cooling tower No. 1	O13
6	Fan No. 7—Proc. cooling tower No. 1	O13
7	Fan No. 8—Proc. cooling tower No. 1	O14
8	Fan No. 9—Proc. cooling tower No. 1	O14
9	Fan No. 10—Proc. cooling tower No. 1	O14

NO.	TITLE—ELECTRIC MOTORS-M	LOC.
1	Fan No. 1—Proc. cooling tower No. 2	O6
2	Fan No. 2—Proc. cooling tower No. 2	O7
3	Fan No. 3—Proc. cooling tower No. 2	O7
4	Fan No. 4—Proc. cooling tower No. 2	O8
5	Fan No. 5—Proc. cooling tower No. 2	O8
6	Fan No. 6—Proc. cooling tower No. 2	O8
7	Fan No. 7—Proc. cooling tower No. 2	O9
8	Fan No. 8—Proc. cooling tower No. 2	O9
9	Fan No. 9—Proc. cooling tower No. 2	O9

NO.	TITLE—HEAT EXCHANGERS	LOC.
1	Debutanizer (Top)	P9
2	Debutanizer (Middle)	P9
3	Debutanizer (Bottom)	P9
4	Oil to oil	P12
5	Oil to oil	P12
6	Oil to oil	P12
7	Oil to oil	P12
8	Oil to oil	Q12
9	Oil to oil	Q12

NO.	TITLE—UNITS	LOC.
1	High-pressure absorbers	Q4-9
2	High-pressure inlet gas scrubber	P5
3	High-pressure inlet gas scrubber	P7
4	High-pressure absorber gas scrubbers	Q4-9
5	Gas scrubber-pipeline absorber	Q9
6	Depropanizer reflux accumulator	P8
7	Depropanizer	P8
8	Depropanizer reboiler	P9
9	Deethanizer feed tank	P9

NO.	TITLE—PUMPS	LOC.
1	Water from Well No. 6	B1
2	Water from Well No. 6 (utility)	J5
3	Water to storage tank	J7
4	Water from Well No. 3	X20
5	Water from Well No. 3 (utility)	X20
6	Distillate return	J21
7	Water to gas-cooling tower No. 1	N5
8	Water to gas-cooling tower No. 1	N5
9	Water to process tower No. 2	P7

NO.	TITLE—CONDENSERS	LOC.
1	Steam evaporation	O19
2	Steam evaporation	O19
3	Cooling overheads off Fractionator No. 1	Q15
4	Cooling overheads off Fractionator No. 1	Q15
5	Cooling overheads off Fractionator No. 2	Q15
6	Cooling overheads off Fractionator No. 2	Q15
7	Cooling overheads off Still No. 2	O10
8	Cooling overheads off Still No. 2	O10
9	Cooling of butane	P9

PUMP SCHEDULE—LA GLORIA OIL & GAS CO., FALFURRIAS PLANT

Item No.	Sch'm. dwg. No.	Loc.	Service	Make	Type	Serial No.	Old or new	Flow rate, g.p.m.	Head, ft.	Hp.	Speed r.p.m.	Suct. press. psig.	Disc. press. psig.	No. stages	Bearings Inboard	Bearings Outboard	Impeller size	Shaft part No.	Sl've part No.	Packing box dimensions
1-A	1	B-1	Water from well No. 6	Peerless		35270	New	500	220	40	1,760			7	R 753	R 1159				
1-B	2	I-5	Water from well No. 6 (utility)	Worthington	1½ D-2	1212530	New	60	52	1.5	3,600			1				7	15	1⅜x1⅞x1⅞
2	3	I-7	Water to storage tank	Worthington	6L-1	1216351	New	1,000	78	20	1,760			1				17	15	
3-A	4	X-20	Water from well No. 3	Fairbanks-Morse			New							3	236	107				
3-B	5	X-20	Water from well No. 3 (utility)	Fairbanks-Morse																
	6	J-21	Raw products feed	Worthington	4½x3¾x4	1041226	Old				Duplex				2308	2308DB	10¼-in.	17	15	2⅞x2⅞x2¾
5-A	7	N-5	Water to gas-cooling tower No. 1	Worthington	8L-1	1066188	Old	3,000	60	65	2,000	0	25	1	2309	7409BGM				3½x2½x3¾
5-B	8	M-5	Water to gas-cooling tower No. 1	Worthington	10LA-1	1184408	New	3,000	60	60	1,800	0	25	1						
6-A	9	P-7	Water to process tower No. 2	Worthington	12LA-1	1184405	New	4,500	92	135	1,450	0	40	1	SKF 2311	7411BGM				3x4x3⅞
6-B	10	P-7	Water to process tower No. 2	Worthington	12LA-1	1184406	New	4,500	92	135	1,450	0	40	1	SKF 2311	7411BGM				3x4x3⅞

DRIVER SCHEDULE—LA GLORIA OIL & GAS CO., FALFURRIAS PLANT

Item No.	Sch'm. dwg. No.	Loc.	Service	Make	Type	Serial No.	Hp.	Speed, r.p.m.	Bearings Inboard	Bearings Outboard	Pack.	Shaft part No.	Water rate, lb./hp.-hr.	Steam flow, lb./hr.	Turbine base make
1-A	1	B-1	Water from well No. 6	G.E.	12F4439	6276789	40	1,760	7313MRC	7212MRC					
1-B	2	I-5	Water from well No. 6 (utility)	Master	PA129388	RK10610	1.5	3,600	207SF	204SFG					
2	3	I-7	Water from storage tank	Westinghouse	CS1077385	4445	20	1,745							
3-A	4	X-20	Water from well No. 3	Fairbanks-Morse	QSZV	394784	10	3,500	432						
3-B	5	X-20	Water from well No. 3 (utility)	Fairbanks-Morse	QZS	371133	1	3,440							
	6	J-21	Raw products feed												
5-A	7	N-5	Water to gas-cooling tower No. 1	Moore	U3R	5522	70	2,000	60	38	46	86	63	2,580	Moore
5-B	8	M-5	Water to gas-cooling tower No. 1	Moore	U2R	11037	60	4,018/1,800	1,048	38	46	86			Moore
6-A	9	P-7	Water to process tower No. 2	Moore	S2RG (85x5)	11035	135	4,015/1,450	60	38	46	86	35.7	11,000	Moore
6-B	10	P-7	Water to process tower No. 2	Moore	S2RG (85x5)	11036	135	4,015/1,450	60	38	46	86	35.7	11,000	Moore

LOCATION		PUMP		SERVICE					
SER. No.	MAKE	TYPE		INSTALLED / /		YEAR 19			
PART NO.	PART — STEAM PUMP	INSP.	REPLACED QTY.	REPLACED DATE	PART NO.	PART — TURBINE	INSP.	REPLACED QTY.	REPLACED DATE
	Piston (Liq) (Steam)					Ball Thrust Bearing			
	Piston Rings (L) (S)					Thrust Sleeve			
	Piston Rod Nut (L) (S)					Ball Thrust Shims			
	Aux. Cylinder					Thrust Sleeve Nut			
	Valve Rod Gland					Oil Ring			
	Aux. Stuff. Box Bush.					Steam End Bearing			
	Aux. Plunger					Oil Baffle (T-End)			
	Aux. Plunger Rings					Thrust Collar Sleeve			
	Aux. Slide Valve					Oil Baffle (G-End)			
	Aux. Cyl. Head					Carbon Ring Spacer (thin)			
	Valve Rod					Carbon Ring Spacer (thick)			
	Valve Rod Knuckle					Carbon Packing Ring			
	Valve Rod Knuckle Pin					Carbon Packing Spring			
	Stub End Valve Rod Link					Carbon Packing Ring Stop			
	Valve Rod Link					Shaft Nut			
	Valve Rod Collar					Shaft			
	Valve Rod Collar Split Nut					Oil Baffle-Pinion			
	Valve Rod Collar Set Screw					Felt, Oil Baffle (Shaft)			
	Tappett					Pinion & Exch. End Bearing			
	Tappett Pin					Gear (Power Takeoff)			
	Fulcrum Pin					Pinion			
	Lever					Gear Shaft Thrust Brng.			
	Stuffing Box Cap (L) (S)					Brng. Nut (Pwr. Takeoff)			
	Stuffing Box Gland (L) (S)					Felt, Oil Baffle (Pwr. Takeoff)			
	Piston Rod (L) (S) (Cont)					Oil Pump Assembly			
	Valves, Intake								
	Valves, Discharge								
DRIVER: TYPE	MAKE	SER. No.		MFGR. Dwg. No.					
PUMP NO.	LOCATION	SERVICE							

Individually styled cards are used for the various classes of equipment and these are further segregated by use of colored backgrounds to simplify handling. Here is one side of the pump card.

tions on the driver. By having this schedule always at hand, it becomes a very simple matter to lift off all pertinent data necessary in ordering parts or a replacement for any of the 122 pumps in the plant.

Plot plan . . . This consists of the layout drawing of the plant which shows all process units and auxiliaries. A letter-and-number grid is used to locate a particular item. Each item carries its grid location in its listing on the plot plan schedule, the pump and driver schedule, and on other plant data sheets.

The second part of the plot plan drawing consists of lists showing the numbers and locations of all pieces of equipment broken down to show process and auxiliary units under their appropriate headings. To avoid the confusion which might exist with the same number appearing several times, a legend has been used for each classification. In the case of the process units, the number is used as is, with only a flag line to connect it to the piece of equipment it relates to on the plot plan. In the case of pumps, the number is enclosed with a circle, heat exchangers are enclosed in a diamond, and condensers in a square, with the flag line connecting to the individual items. The turbine and electric-motor classifications are preceded by the letters "T" and "M," respectively.

Index cards . . . Equipment record cards serve as a further aid in maintaining equipment. The cards are used to record pertinent data on gas-engine compressors, generators, pumps and drivers, cooling-tower fans, boilers, condensers, heat exchangers, and electric motors. Individually styled cards are used for the various classifications of equipment and these are further segregated by use of colored backgrounds to simplify handling. A handy card file is used to hold the individual cards so they may be quickly scanned when drawing up a maintenance program or so that entries may be conveniently made.

The cards used for the various classifications are blocked off so that pertinent data may be listed so as to provide a quick rundown on the item's history. For instance, the gas-engine-compressor cards provide a space across the top for vital information, such as engine number, serial number, make and model, and then list the significant parts involved so each has a vertical check-off column. The eight power cylinders plus the four compressor cylinders are listed on horizontal lines which intersect the vertical columns. Each cylinder may then be checked off against various parts, such as piston, piston rings, piston pin, piston-pin bushing, connecting-rod bearing, etc. If over a period of time a particular part requires excessive replacement, it will show up on the back of the record where tabulations are kept on replacements. An excessive number of replacements will lead to an investigation to offset more severe difficulties which may develop if corrective measures are not taken.

A lubrication record plus an engineering record also are kept on the rear of the card as a further record on the performance of the individual compressor.

In keeping a check on condensers, the record provides space for maintaining a running account of the various temperatures and pressures on each unit. If a trend develops which might indicate leaking tubes, it can easily be noted in the bimonthly entries.

The record cards for the pumps and motors and generators provide space for checkoff on various parts. Such items as tappets, tappet pins, fulcrum pins, intake and discharge valves are included on the pump card while commutators, brushes, and collector rings are listed with the motor-generator cards.

The foregoing combination of pump and driver schedule, plot plan, and code and record index cards are significant factors in keeping a maintenance program functioning smoothly. Some modifications will no doubt be necessary to meet local conditions, but La Gloria's system warrants consideration as a basic approach in setting up any maintenance program.

Fundamentals of Gas Lift—8

How to Place the Borderline Gas-Lift Well

. . . only a complete analysis will establish its category

by C. V. Kirkpatrick

THE borderline well is characterized by a relatively low productivity index (approximately 0.5 or less) and moderately high liquid producing rates of 250 to 350 bbl. per day. The question that arises is determining which flow process, continuous or intermittent, will produce the most liquid for the least amount of injected gas at the available pressures. The continuous-flow process, if properly instituted, should be inherently more efficient because the gas is put to work as needed and dissipation of energy in overcoming starting inertia is low. Moreover, the external work done by the gas is negligible.

The fact is, however, that maximum efficiency in the continuous-flow process can only be realized by putting the gas to work as soon as possible, meaning high injection pressures at moderate depths. Because the high injection pressure necessary for maximum efficiency is seldom available, it has been found in practice that intermittent flow is usually more efficient than continuous flow for wells that produce moderate amounts of liquid.

Regions of flow are often encountered in the continuous-flow process in which maximum slippage and liquid hang-up exists. Further, it is generally true that the performance of a well with a low productivity index is characteristically less predictable than that of a well with a high P.I. This condition also favors the intermittent operation over the continuous.

Available pressure, desired production, and well P.I. will most often determine the category of the well.

Complete analysis needed . . . The borderline well, however, will in almost all instances produce more efficiently in one or the other categories; and, therefore, a complete analysis of both types of flow will definitely establish the proper category.

The intermittent well example problem worked out in the foregoing installment is actually a borderline well. It is characteristic of a high bottom-hole pressure, low-productivity-index well; therefore, a complete analysis for both continuous and intermittent flow will be made to determine the one that will yield the optimum results for that well.

Author is chairman, department of petroleum engineering, University of Houston.

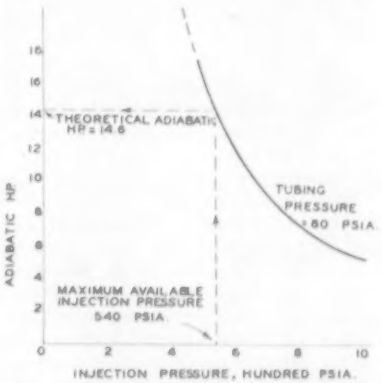

THEORETICAL ADIABATIC HP = 14.6
TUBING PRESSURE = 80 PSIA
MAXIMUM AVAILABLE INJECTION PRESSURE 540 PSIA
ADIABATIC HP
INJECTION PRESSURE, HUNDRED PSIA

FIG. 1—To properly categorize a borderline well for gas lift, this plot of continuous-flow gradients as a function of injection depth and pressure is a valuable tool.

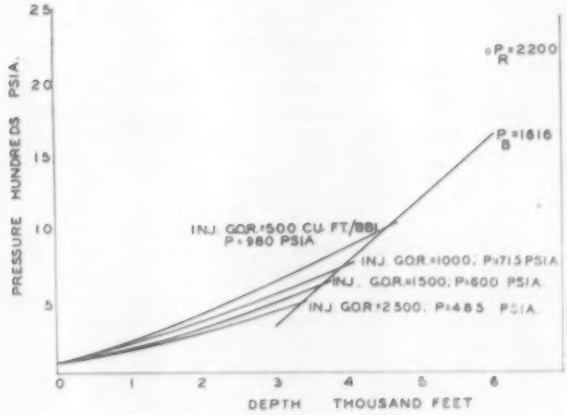

P = 2200 R
P = 1616 B
INJ. GOR = 500 CU. FT/BBL P = 980 PSIA
INJ. GOR = 1000, P = 715 PSIA
INJ. GOR = 1500, P = 600 PSIA
INJ. GOR = 2500, P = 485 PSIA
PRESSURE HUNDREDS PSIA.
DEPTH THOUSAND FEET

FIG. 2—(Left) For continuous flow of the borderline well, the maximum available pressure of 540 psia. gives an adiabatic horsepower of 14.6.

FIG. 3—(Right) An injection gas-oil ratio of 1,920 will be required for continuous flow of the borderline well with only 540 psia. available.

Given:

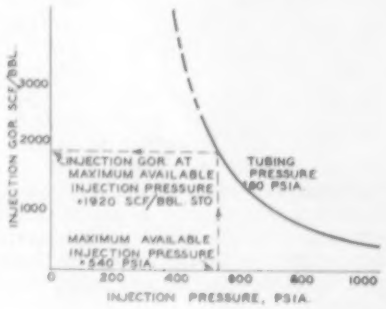
1. P.I. of well = 0.50
2. Maximum available casing well-head pressure = 520 psi.
3. Depth of well = 6,000 ft.
4. Gravity of oil = 31.4° A.P.I.
5. Gravity of lift gas = 0.60.
6. Gravity of solution gas = 0.60.
7. Tubing pressure = 80 psia.
8. Water-oil ratio = 2.56 to 1.
9. Oil production desired = 82 bbl. per day.
10. Total liquid production = 292 bbl. per day.
11. Separator gas gravity = 0.60.
12. Well-head temperature = 85° F. = 545° R.
13. Shut-in b.hp. = 2,200 psia.
14. Tubing size = 2-in.
15. Casing size = 7-in.

Required: Optimum conditions for gas lift.

Solution:

Complete analysis will be made for continuous flow design using data given in statistical average charts and following the procedure outlined in Installments 3 through 7. Supplementary data:

1. Reservoir temperature = 70 + (1.6) (60) = 166° F.
2. From Fig. 1, Installment 3, solution G.O.R. at 2,200 psia. and 150° F. = 330 cu. ft. per bbl.
3. From Fig. 2, Installment 3, saturation pressure = 2,200 psia.
4. From Fig. 3, Installment 3, liquid volume factor = 1.14 at 2,200 psia. and 150° F.


INJECTION GOR AT MAXIMUM AVAILABLE INJECTION PRESSURE = 1920 SCF/BBL. STO
TUBING PRESSURE 80 PSIA
MAXIMUM AVAILABLE INJECTION PRESSURE = 540 PSIA
INJECTION GOR, SCF/BBL.
INJECTION PRESSURE, PSIA.

5. Drawdown required = 292/0.5 = 584 psi.

6. B.hp. flowing for 82 bbl. oil (292 bbl. total fluid) = 2,200 − 584 = 1,616 psia.

7. Solution G.O.R. at 1,616 psia. and 150° F. = 220 cu. ft. per bbl.

8. Initial assumed injection gas-fluid ratio = 500 cu. ft. per bbl.

The results of this analysis are shown in Figs. 1, 2, and 3; and Fig. 1 shows the flowing gradient for different injection G.O.R.'s and 80 psia. tubing pressure.

Fig. 2 is a plot of injection pressure versus theoretical adiabatic horsepower, and it can be seen that the maximum available injection pressure of 540 psia. gives a value of approximately 14.6 hp.

Fig. 3 shows that this maximum injection pressure will require an injection gas-oil ratio of approximately 1,920 cu. ft. per bbl. Hence, comparison with the values in the preceding installment shows that the most efficient producing mechanism for the producing conditions of this well is intermittent flow.

It is to be noted, however, that the well is producing at maximum cycle frequency, in order to obtain the 82 bbl. of oil per day. If the water-oil ratio begins to increase or the injection depth becomes greater, necessitating a longer cycle duration, the desired production cannot be obtained. Under these conditions, it may be desirable to switch to continuous flow, in order to increase the total fluid take. This obviously can only be done at the sacrifice of operating efficiency, but the question is decided on the basis of the amount of stock-tank oil desired and the maximum allowable gas-oil ratio.

Middle East Oil Payments Rise 34 Cents in 6 Years

by Gordon H. Barrows

PER barrel payments by oil companies to governments have shown a higher rate of increase since the end of World War II in the producing countries of the Middle East than in any other area of the world. The importance of these increases and the publication of recent data on government incomes in the Middle East—such as the United Nations studies—form the basis for this article's examination of these payments in recent years.

The average per barrel payment in the Middle East has risen, as accompanying figures indicate, from an average of about 20 cents per barrel in 1948 to 53 cents per barrel in 1952 and to an estimated 54 cents per barrel in 1954. The primary factor in this increase has been the revision of concession terms to the 50-50 basis, involving higher royalty rates, tax payments, etc.

Even where countries are on the 50-50 basis there exists a difference in the rate of per barrel payment, as the figures indicate. This is to be expected for the concession agreements are not the same, especially as concerns the inclusion of foreign taxes, lifting prices, special incentive to production, etc. Further, payments in some countries have increased faster than in others. This fluctuation depends partly on the time when the concession terms were changed. For example, the 50-50 arrangement was in effect in 1950 in Aramco's operations in Saudi Arabia but did not arrive until September 1952 in Qatar, accounting for the lower Qatar payments in that year. Another factor causing fluctuation in the per barrel rate of payments in the sterling countries was the devaluation of the pound in 1949, as illustrated in the case of Kuwait which fell to a low of 9 cents in 1950.

Given this increase in per barrel rates it is to be expected that total direct payments to governments of the producing countries would increase. When the per barrel increase is coupled with the jump in production levels which has occurred in the Middle East, the result is to increase total direct payments to governments from less than 100 million dollars in 1948 to a level estimated over 500 million dollars in 1953.

This flood of oil income has not been an unmixed blessing to the Middle East. One result has been the growing dependence of the producing governments on oil for their governmental revenues. These oil payments far exceed income from any other source. For example, about 100 per cent of governmental revenues in Kuwait and Qatar result from oil payments and even in the larger countries such as Saudi Arabia or Iraq this dependence exceeds 80 per cent. The percentage of total foreign exchange which is derived from oil is, of course, even higher.

How to Use the Income

The risk of this income and oil development in the Middle East is the possible disruption of the local economies—which are among the poorest in the world—for example, by attracting the labor force away from its old and traditional occupations into oil. This and other factors tend to create an overspecialized economy which is less balanced and therefore less inherently stable than before.

As a result, a great deal of time and thought have been devoted to finding a means of utilizing the oil income to the maximum advantage of the recipient countries. In this, the oil companies are cooperating but the greater part must come from the producing countries themselves.

The author is the head of Foreign Business Consultants, 2128 Florida Avenue, N. W., Washington, D. C., a reporting organization to oil companies interested in operations abroad. The accompanying article is extracted from his book, The International Petroleum Industry, to appear following January 1, 1955. Information concerning same may be obtained from Mr. Barrows by writing Suite 208, 34 Park Row, New York, 38.

PER BARREL PAYMENTS IN THE MIDDLE EAST

(U. S. Cents)

	1953[a]	1952	1951	1950	1948
Iraq	66	68	60	30	33
Bahrein	57[b]	57	35	30	13
Saudi Arabia	56[c,b]	56	56	56	22
Kuwait	53	51	14	9	13
Iran			18[b]	18[b]	19[b]
Qatar	[na]	36	21	9	
Neutral Zone	55[d] 35[e]				

[a]Preliminary. [b]Partly estimated. [c]Applies only to Aramco's operations. [d]Payment by Pacific Western Co. in Saudi Arabian section of Neutral Zone. There is, in addition, a 20-25 per cent net profits sharing agreement. [e]Payment by American Independent in Kuwait section of Neutral Zone. There is, in addition, a 15 per cent net profits sharing agreement.

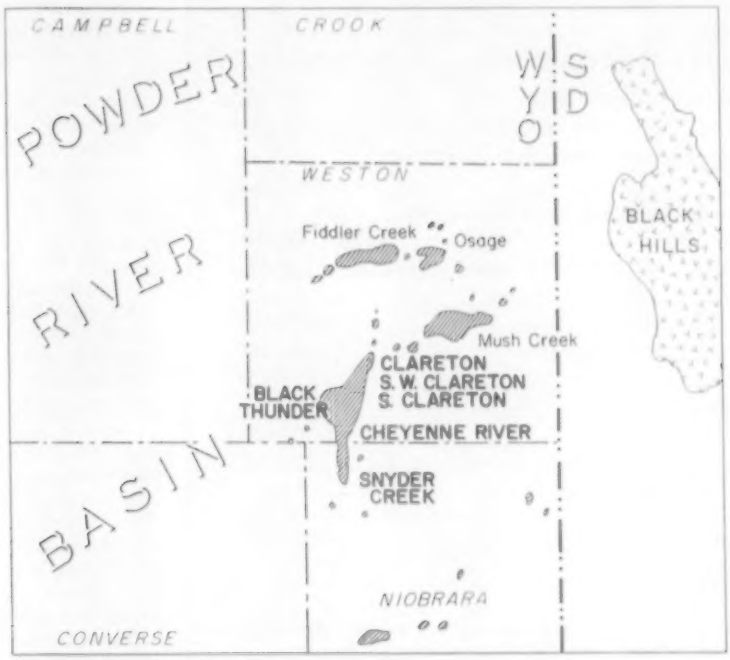


Fig. 1—Production in Weston and Niobrara counties is from the Newcastle sand at depths ranging from 5,500-7,000 ft.

SPECIAL REPORT

Greater Clareton Area Should Have an Economic Life of 15 Years or More

Better production methods and secondary-recovery operations may add many years

by J. G. Crawford

THE Greater Clareton area, Weston and Niobrara counties, Wyoming, is in a state of flux. Wells are constantly being drilled and brought on production, and productive limits pushed out here and there. Involuntary proration has been in effect due to limitation of transportation facilities and market for the oil. Some operators have contracts that permit rather steady production, other operators are shut in for lack of a market, but the majority of the operators produce under proration and as a consequence their production is irregular.

Though individual wells and leases show sharp production declines, the area as a whole is on the ascending side of the production curve, new wells and proration maintaining and increasing its potential.

Chemical & Geological Laboratories, a Wyoming corporation, was authorized by the Wyoming Oil and Gas Conservation Commission to conduct a survey of the Greater Clareton area for the purpose of obtaining factual data concerning the Newcastle sand reservoir of that area. It was suggested that this initial effort to obtain reservoir information would consist of a series of pressure tests sufficient in number and extent to give an areal weighted average, a series of producing gas-oil ratios, and two bottom-hole samples from which reservoir fluid characteristics could be determined. It was felt that this basic information would permit certain deductions as to oil in place and present status of the reservoir.

Author is president of Chemical & Geological Laboratories, Casper, Wyo.

History

Osage field . . . Oil production was first found in this field in 1919 when the Mike Henry Oil Co. well No. 2 came in with an initial production of 40 bbl. of oil per day from the Belle Fourche shale; this oil was apparently from cracks, fissures, and fractures in the shale. In 1920, the Alliance Oil Co. well No. 1 came in flowing from the Newcastle sandstone.

Osage field was never large, and even in its most prolific years of 1930-1933 its reported production just barely exceeded 1,000 bbl. per day. It is still producing some oil, the average production for the past 3 years being approximately 270 bbl. of oil per day. Accumulated production to December 31, 1953, is approximately 6,600,000 bbl. of oil; most of this oil, though not all, has come from the Newcastle sandstone.

The inclusion of Osage field in a reservoir study of the Greater Clareton area is for comparative purposes. All of the reservoirs in Weston County have been of the same general nature with the same type of drive, though differing in solution-gas ratio. It can be expected that, within limits, the production of the Greater Clareton

Greater Clareton Reservoir . . . in brief

Estimated productive limits (April 1954), acres	70,076
Stock tank oil in place (volumetric calculation), bbl.	351,000,000
Stock tank oil in place (pressure decline calculation), bbl.	421,000,000
Gas initially in place (pressure decline calculation), M.c.f.	337,000,000
Initial reservoir pressure (at 2,500 ft. subsea), psi.	3,024
Measured areal pressure (April 1954), psi.	2,304
Oil produced to April 1954, bbl.	5,000,000
Gas produced to April 1954, M.c.f.	4,000,000
Areal producing gas-oil ratio, cu. ft. per bbl.	1,180
Estimated recoverable stock tank oil (primary methods), bbl.	72,000,000
Estimated recoverable gas (primary methods), M.c.f.	270,000,000
Economic life of average well (unrestricted production), years	5-6
Economic life of Greater Clareton area (present conditions), years	15

area, when fully developed, will parallel the decline curve of the older fields.

Osage field, as far as can be determined with the information available, consisted of 6,840 productive acres with an average sand thickness of 10 ft. Production to date then, after 30 years, has averaged less than 100 bbl. per acre-foot.

Mush Creek-Skull Creek . . . Oil was first discovered in February 1944 by Western Oil & Gas Co. 1 Milhouse. This well had an initial production of 80 bbl. per day. In October 1945, oil was found in the Newcastle sandstone by the Morton-Siegel 1 State; this well only averaged 3 bbl. of oil and 7 bbl. of water per day. In March 1947, Mush Creek Oil Co. 1 Smith came in with an initial production of 28 bbl. of oil per day.

Oil was first discovered in Skull Creek field in June 1948.

The area now known as West Mush Creek is still in the process of development and oil production from this portion of Mush Creek-Skull Creek field has succeeded in arresting the decline of the older portion of the field. West Mush Creek now appears to be an extension of Mush Creek field, and the reservoir is probably a continuation of the Mush Creek-Skull Creek reservoir with its many isolated, lenticular areas of productivity.

The average net pay thickness of the 14,828 acres in Mush Creek-Skull Creek field will approximate 8 ft., in which case the area has averaged to the end of 1953 a recovery of 76 bbl. per acre-foot.

Fiddler Creek-Hay Creek . . . Fiddler Creek oil field was discovered in September 1948 with completion of Clark Drilling Co. 1 Witzel.

Unlike the Mush Creek-Skull Creek area, a continuous sand body was outlined with porosity increasing westward until porosities of 24 per cent were common. The entire productive area, including Hay Creek, comprises 8,300 acres with an average net pay thickness of 10 ft. Production to December 31, 1953, has totaled 113 bbl. per acre-foot.

Greater Clareton . . . The area under study in this survey is called Greater Clareton and consists of all acreage south of Township 44n. For further identification Greater Clareton has been divided into the following fields (Fig. 2):

Clareton	43n-64, 65, 66w
Hampshire	42n-65w
Black Thunder	42n-66w
Cheyenne River	41n-66w
Sherwin	41n-67w
Snyder Creek	40n-66w
Dogie Creek	39n-66w

Clareton field was discovered by Lodgepole Development Co. 1 State, completed and put on production July 22, 1950; the well flowed 30 bbl. of oil per day on completion.

After 3½ years of development, to December 31, 1953, there were 148 wells on production, averaging under proration 48 bbl. of oil per day per well, with an accumulated production of 3,327,201 bbl. The field has shown no decline, new completions offsetting the production decline of the older wells.

As of December 31, 1953, Black Thunder and Hampshire fields had 105 prorated producing wells averaging 19 bbl. of oil per day per well with an accumulated production of 510,595 bbl. since January 1953.

Nineteen wells were completed for production in Cheyenne River field by December 31, 1953, but most of these wells were shut in for lack of pipeline connections. Accumulated production was 124,564 bbl. from August 1953 through December 31, 1953.

No oil was produced in 1953 from Snyder Creek or Sherwin wells, though two wells were completed in Sherwin field in 1953; there were no completions in Snyder Creek field in 1953.

Geology

Structure . . . The Greater Clareton area lies on the east rim of the Powder River basin and on the western margin of the Black Hills uplift. It lies basinward from, and is an extension of, the West Mush Creek and Mush Creek trend that lies to the northeast. The surface rocks reflect a monoclinal dip to the southwest at a rate of approximately 2°.

Oil production is found in the Newcastle sandstone, and contours on the datum bed just above the Newcastle formation duplicate the surface monoclinal dip. The reservoir is a stratigraphic trap, and the accumulation of oil in the area is directly related to the facies changes in sediments, porosity, permeability, and the thickness of the sand.

Stratigraphy . . . The Newcastle formation (Muddy equivalent) is the producing horizon at Clareton. At its fullest development, it consists of five sandstone beds designated from the basal member upwards as: A, B, C, D, and E.

In the Greater Clareton area oil production is obtained from the A, B, and C beds. Depending upon their development, these three sand units coalesce or are oil productive separately. The sand conditions of these individual units are very erratic, ranging from shale facies to well-developed sands having maximum effective sand thicknesses up to 20 ft. In the Clareton area proper, the sandstone units exhibit larger grain size, better porosities and better permeabilities than have been found to date in the areas to the southwest.

Production

In the Greater Clareton area as of April 1, 1954, there were 376 producing wells with 59 producing companies. Total cumulative oil production for the area to December 31, 1953, is 3,962,360 bbl. An estimate of production for the first quarter of 1954, based upon

November and December runs, gives a figure of approximately 5,000,000 bbl. produced as of April 1, 1954.

Reservoir Data

A volumetric estimate of reservoir space within the present estimated productive limits is difficult to make. In Clareton and Black Thunder fields there is apparently a rather permeable, porous zone of 7 to 16 ft. in thickness topped by a tight, low-porosity zone that averages 20 ft. in thickness. The upper, shaly, tight zone has been tested and found to produce oil, though not in the quantities the lower pay can yield. Storage of oil in this portion of the reservoir must be considered, even though recoverable oil may be low.

Cheyenne River, Snyder Creek, and Sherwin fields do not appear to have the permeable, porous phase of the pay section, or at best only a foot or two, but rather consist of a tight shaly sand with excellent fracture development and low average net thickness. Further, the reservoir in these fields seems to be more uniform with a continuity that is not as apparent in Clareton and Black Thunder fields.

The acreage by fields within the present estimated productive limits and the volumetric estimate of the reservoir space therein are as follows:

	Lower zone	Upper zone
Clareton (43n-64, 65, 66w):		
Total acreage	12,900	
Estimated average porosity, per cent	12	6
Estimated average net pay thickness, ft.	10	20
Estimated connate water, per cent	22	40
Black Thunder-Hampshire (42n-65, 66w):		
Total acreage	17,400	
Estimated average porosity, per cent	12	6
Estimated average net pay thickness, ft.	10	20
Estimated connate water, per cent	22	40
Cheyenne River (41n-66w):		Prod. zone
Total acreage		21,900
Estimated average porosity, per cent		8
Estimated average net pay thickness, ft.		12
Estimated connate water, per cent		35
Sherwin (41n-67w):		
Total acreage		10,316
Estimated average porosity, per cent		6
Estimated average net pay thickness, ft.		8
Estimated connate water, per cent		35
Snyder Creek (40n-66w):		
Total acreage		7,560
Estimated average porosity, per cent		6
Estimated average net pay thickness, ft.		8
Estimated connate water, per cent		35

Acre-feet of reservoir space in the Greater Clareton fields within the estimated productive limits calculates by the above factors as follows:

Clareton	240,198,000
Black Thunder-Hampshire	323,988,000
Cheyenne River	163,198,800
Sherwin	38,416,784
Snyder Creek	28,153,440
Greater Clareton area	793,955,024

Greater Clareton Reservoir

These 70,076 productive acres are not believed to outline a single continuous reservoir. Field data point to the probability of a multiple reservoir system containing fluids of somewhat differing characteristics. It is known that two, and possibly three, sands produce in the area and it was thought that coalescing of the sands would permit intercommunication such that reservoir fluid characteristics would be substantially the same throughout the reservoir. This does not appear to be the case. Available data show varying reservoir fluid characteristics and more variation might be shown were more samples obtained and analyzed.

In any event, the Greater Clareton reservoir will be treated as a single unit in the preliminary study.

Type of drive . . . History of Osage, Mush Creek, Fiddler Creek, and Clareton has shown conclusively and without question that type of drive in Newcastle sandstone is solution gas and solution gas only. There has been no evidence of even a partial water drive nor is there any evidence of gas-cap assistance. Further, the gentle dip of the beds precludes any probability of the formation of a secondary gas cap which could aid in the later stages of production. Neither does it appear that drainage will add any appreciable oil to the ultimate recovery.

The only drive mechanism in this field is that of the dissolved gas, and this method of displacement is inherently and basically an inefficient process beyond the control of the operator. In this process the reservoir pressure must continuously decline to make the dissolved gas available; as the oil and gas are produced, more reservoir space must be filled by the gas released from solution, which leaves less gas available to produce oil. It is a vicious circle.

The Greater Clareton reservoir produces oil by this inefficient type of drive. The oil is undersaturated, because the quantity of gas is only about half of what the oil could hold. Thus, the pressure of the reservoir must be reduced to the bubble point of the oil before the solution-gas-drive mechanism can begin to operate.

There is no gas cap to aid; there is no water to move into the vacated pore space and help maintain pressure. Recovery will be poor and the only possible way in which this reservoir can be helped will be the secondary operations.

Initial oil in place . . . Use of volumetric calculations previously given, together with the formation volume factors of 1.53, 1.50, and 1.60 from reservoir fluid analyses, gives stock-tank oil initially in place in the Greater Clareton area as:

	Bbl. connate water	Bbl. stock-tank oil
Clareton field	74,461,400	108,324,400
Black Thunder-Hampshire	100,436,300	149,034,500
Cheyenne River field	57,119,600	66,299,500
Sherwin pool	13,445,900	15,606,800
Snyder Creek pool	9,853,700	11,437,300
Total Greater Clareton area	255,316,900	350,702,500

Thus, stock-tank oil originally in the reservoir by volumetric calculations can be rounded off to 351 million barrels. This is the estimated amount within the defined productive limits as of April 1, 1954.

Initial reservoir conditions . . . The initial reservoir conditions of the oil pool can be deduced from the volumetric data, bottom-hole-sample analyses, and pressure tests in the area. It is realized that the volumetric data are scanty and insufficient for a positive estimate of oil in place; the use of the data already shown is the best that can be done under the circumstances. As more data become available the estimates herein can be adjusted. However, it is felt that this report is primarily a starting point for a chart of the progress of the field, and the figures can be revised to include the new data as the limits of the field, net pay thicknesses, porosity, and connate water are better defined.

The initial reservoir pressure has been arrived at by consideration of all reports and measurements available. In the absence of any higher measured pressures, including the present survey, 3,024 psi. has been accepted here as the initial reservoir pressure of the Greater Clareton area at a datum of —2,500.

Pertinent initial reservoir conditions, averaged from three analyses, are as follows:

Reservoir pressure (—2,500 datum), psi.	3,024
Saturation pressure (bubble point), psi.	1,700
Formation volume factor	1.53
Solution gas ratio, cu. ft./bbl.	800
Compressibility factor	165×10^{-7}

Present reservoir conditions . . . Pressure tests in the Greater Clareton area

were conducted March 24-April 9, and April 30-May 1. Many of the wells tested during these two periods had been shut in for days, others shut in for a month or more, and others shut in for 24 hours. The wells in the Black Thunder and Cheyenne River areas presented no difficulties in taking bottom-hole pressures, but the wells in the Clareton area caused trouble due to paraffin accumulations.

All pressures were calculated at a datum of —2,500. Gradients varied from 28.8 to 32.0 psi. per 100 ft. with the average about 29.9 psi.

Field gas-oil ratios were obtained from leases prior to and during the test period. The gas-oil ratios were for the most part 24-hour runs, the gas volumes being computed from charts whereas the oil volumes were obtained from the pumper.

As of April 1, 1954, the following reservoir conditions were submitted:

Areal weighted pressure (—2,500), psig.	2,304
Areal weighted G.O.R., cu. ft./bbl.	1,180
Stock-tank oil produced, bbl.	5,000,000
Gas produced, M.M.c.f.	4,000

There is no portion of the 70,076 acres within the estimated productive limits that appears to equal the initial reservoir pressure of 3,024 psi. unless it might be in the undrilled acreage south and west of Township 42n. The reservoir pressure has been lowered to some extent within the entire estimated productive limits.

Size of reservoir . . . The pressure data now available enables us to estimate the size of the reservoir. Production to date has come from fluid expansion in the reservoir, and the relationship between produced oil, compressibility, and pressure drop is as follows:

$$N = \frac{\Delta N}{\Delta P \times C}$$

in which:

- N = stock-tank oil initially in the reservoir
- ΔN = stock-tank oil produced
- ΔP = pressure drop for production of ΔN
- C = compressibility factor

Substituting in the above equation, we have:

$$N = \frac{5{,}000{,}000}{720\ (165 \times 10^{-7})}$$

$$N = 421{,}000{,}000 \text{ bbl.}$$

This figure of 421 million barrels does not agree with the calculated stock-tank oil in place of about 351 million barrels arrived at by volumetric methods. This discrepancy is probably due principally to inability at the present time to define adequately the reservoir limits and to evaluate properly the thickness and porosity of the pay section in the present producing area.

It must also be remembered that there is no reason to believe that the Greater Clareton reservoir is a separate and distinct unit from West Mush Creek, or Skull Creek. It is probable that there are sands developing coalescing, and pinching out in such manner as to make for a complex system of separate reservoirs within a trend. This is particularly true of Skull Creek and Mush Creek where dry holes have been drilled one location from good producing wells within the productive limits.

It would appear that more weight should be placed on the 421-million-barrel reservoir than the 351-million-barrel reservoir calculated by unsatisfactory volumetric methods. Accordingly, the size of the Greater Clareton reservoir will be assumed to be:

Stock-tank oil in place, bbl.	421,000,000
Solution gas in place, M.M.c.f.	337,000

Recoverable Oil by Primary Methods

When all the formulas and methods of estimating recoverable oil by solution gas expansion are boiled down to a porosity basis, recoveries are found to range from 5 to 13 bbl. per acre-foot per 1 per cent of porosity. Applying this rule to the estimated 160 bbl. per acre-foot recovery from Fiddler Creek-Hay Creek, this would be 8 bbl. per acre-foot per per cent of porosity.

When the size of the reservoir can be determined by volumetric methods or by pressure drop, recoveries can be stated in percentage of stock-tank oil in place with no reference to acres or acre-feet. Recoveries then range from 7 per cent to a maximum of 26 per cent of the stock-tank oil in place, depending upon the characteristics of the formation and its reservoir fluids. It has been estimated by the pressure-drop method that there are 421 million barrels of oil originally in place in the Greater Clareton reservoir; it has also been pointed out there is a change in formation characteristics from Black Thunder south in which sand conditions grade into a tight but fractured, low-porosity rock. It is thus predicted that the Cheyenne River, Sherwin, and Snyder Creek recoveries would be on the low end of the scale, where the Clareton, Hampshire, and Black Thunder recoveries would be considerably greater.

Taking all these factors into consideration, the estimate of recoverable oil by primary methods only is 17 per cent of the 421 million barrels of stock-tank oil, or 72 million barrels. Recoveries in the south end of the field may not exceed 7 per cent of the stock-tank oil in place, whereas recoveries in the Clareton and Hampshire areas may reach 20 to 24 per cent of the stock-tank oil in place.

A recovery of 72 million barrels averages out at approximately 1,025 bbl. per acre for the entire 70,076 productive acres, and 65,000 bbl. per well for an estimated 1,100 wells to completely develop the area.

Recoverable Gas by Primary Methods

The amount of gas produced from a solution-gas-expansion reservoir bears no relationship to amount or rate of oil production. There will remain in the reservoir upon depletion only the quantity of gas required to fill the voided pore space at the pressure and temperature of the depleted formation, and the quantity of gas that will remain in solution in the residual oil at the temperature and pressure of the depleted reservoir. All of the rest of the gas will have been produced.

Previous calculations have shown that recoverable gas from a reservoir such as Greater Clareton will approximate 80 per cent of the gas in place. The original gas in place in the Greater Clareton reservoir was calculated at 337 billion cubic feet; recoverable gas should approximate 270 billion cubic feet.

Drainage Area and Well Spacing

There is very definite evidence in Cheyenne River field and south that the fractured condition of the reservoir provides a large drainage area. Pressure tests in a number of wells over several months' time show rather conclusively that well interference and pressure drawdown can be felt for miles.

No well tested in Cheyenne River, Snyder Creek, or Sherwin fields equaled the initial reservoir pressure even though the wells had been shut in since completion and testing. Further, the pressure gradient sags as the heavily produced Sections 11 and 14 are approached. It is felt that this portion of the reservoir intercommunicates by virtue of fractures, and that the drainage area of an individual well can be very large.

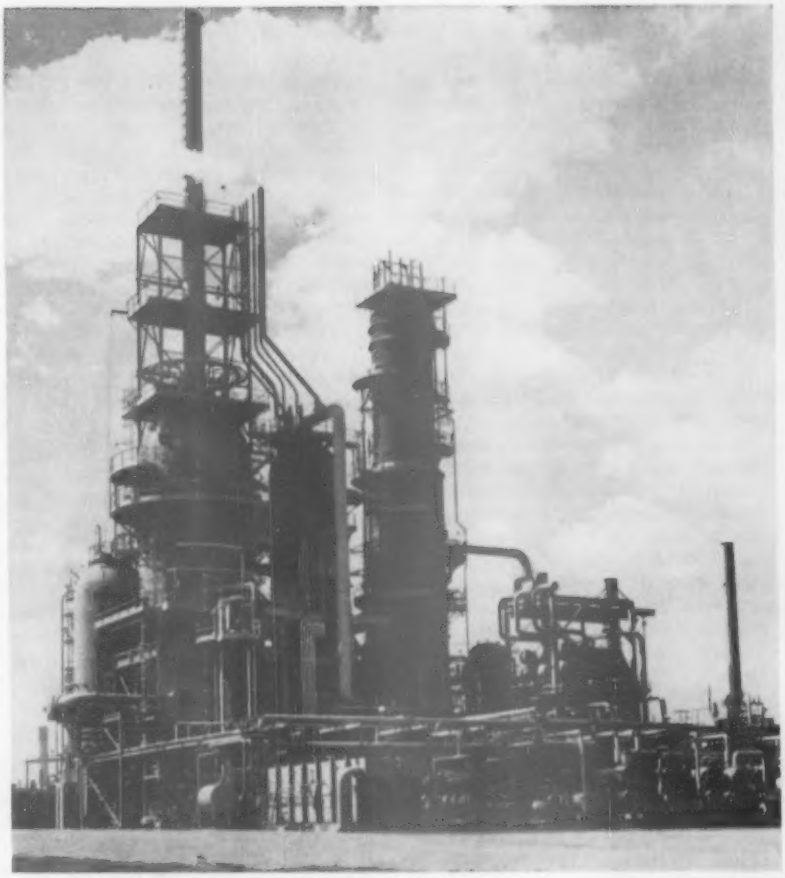
The over-all average of 1,025 bbl. per acre of recoverable oil is not commercial on a 40-acre spacing. Clareton, Hampshire, and most of Black Thunder will support a 40-acre spacing program as the per acre recovery in the thicker sand sections of the area may reach 1,500 to 1,800 bbl. From Cheyenne River south the per acre recovery will be low, perhaps averaging 500 to 600 bbl., and wells cannot be expected to pay out in a 40-acre pattern. A 160-acre pattern in this area is recommended.

Two Panels

This material covers two panels held by the Western Petroleum Refiners' Association at El Dorado, Ark.

Panel Moderator was E. A. Heike, Premier Oil Refining Co., Fort Worth, Tex. The refining panels included Dr. N. K. Anderson, Deep Rock Oil Corp., Cushing, Okla.; W. M. Carney, Lion Oil Co., El Dorado; A. D. Fischbeck, Phillips Petroleum Co., Bartlesville, Okla.; H. K. Wheeler, Pan-Am Southern Corp., El Dorado; J. A. Gearhart, American Liberty Oil Co., Mt. Pleasant, Tex.; Ray E. Feasel, Deep Rock Oil Corp., Cushing, Okla.; Roy S. Wilson, Lion Oil Co., El Dorado; J. M. Brown, Pan-Am Southern Corp., El Dorado.

The engineering panels included D. B. Ardern, Houdry Process Corp., Philadelphia; C. O. Brown, American Cyanamid Co., Chicago; Davis Read, Universal Oil Products Co., Des Plaines, Ill.; E. C. Tinsley, Mexico Refractories Co., Mexico, Mo.; J. G. Eckhouse, Universal Oil Products Co., Des Plaines, Ill.; Dr. Charles W. Rippie, Electric Process Co., Summit, N. J.; D. E. Norris, Houdry Process Corp., Philadelphia; F. D. Parker, Blaw-Knox Co., chemical plant division, Tulsa; E. A. Edwards, Phillips Petroleum Co., Bartlesville, Okla.



TYPICAL CAT CRACKER . . . This 24,000-bbl. per day unit of Esso at Everett, Mass., typifies the more modern installations in this country.

What you should know about

OPERATING THE CAT CRACKER

CO_2 to CO Ratio . . . Afterburning

Q. In fluid cat cracking, what conditions have an effect on the CO_2/CO ratio?

A. The type of catalyst used is an important factor when oxygen is in excess. Synthetic catalysts give more CO—2 or 3 to 1 ratio of CO_2/CO on synthetic and 3 or 4 to 1 on natural catalyst. Temperature must also be considered as a factor and oxygen-deficient conditions are another matter. Other factors are air distribution through the grid and particle size.

One refiner gave some data on a fluid unit in which, during some months, carbon level on the catalyst was run up to about 3 to 3.5 per cent. Regenerator temperatures ran from 1,080° to 1,140° F. In this temperature range, and in the range from 0.6 to 3.5 per cent carbon on regenerated catalyst, no consistent effect was noted on CO_2/CO ratio. Running at an outlet oxygen concentration of 0.5 per cent or less was attempted.

Under those conditions, the conclusion was reached that these variables within the given ranges had no effect on CO_2/CO ratio. (A later question regarding the effect of carbon level on catalyst brought the answer from another panel member that increase of carbon content of regenerated catalyst apparently increases CO_2/CO ratio.)

Another panel member stated that his experience confirmed pretty well what had been said with regard to feed-stock characteristics. No effect had been found from the usual feed-stock characteristics such as gravity, boiling range, and other common properties of the CO_2/CO ratio. Pilot plant data showed that air space velocity (expressed as standard cubic feet per hour, per pound of catalyst in the regenerator) has an effect on CO_2/CO ratio where other variables are constant. Increase in air space velocity decreases the CO_2/CO ratio. It is suspected, however, that metal content of the feed stock would have an effect on the CO_2/CO ratio.

Q. In F.C.C. units, what is the most

effective means of prevention and control of afterburning in the regenerator?

A. The most effective means, one panel member stated, is good design—that is, getting the proper air distribution to the regenerator. The method of control is good operation that avoids, as far as possible, drastic upsets in the feed rate and carbon content of the catalyst. If afterburning does occur in such cases, it is reduced and prevented by water sprays in the top of the regenerator.

Q. Does catalyst level have anything to do with afterburning?

A. Yes, it probably does. The coke-burning capacity would increase as the amount of catalyst is increased. The range over which that occurs is not absolutely certain. Pilot plant data show this: Increasing the air space velocity from 2 to 8 decreases the CO_2/CO ratio from 2 to 1. That is quite a range, however, and no such variation is normally noted on a commercial unit.

Q. What is the difference in the effect of natural and synthetic catalysts on the CO_2/CO ratio?

A. This goes back to what has been said about metals in the feed stock which are later deposited on the catalyst and then turned into various oxidation promoters. They promote the combustion reaction of carbon with oxygen to CO_2. If a catalyst has high metals content (the natural catalysts tend to have more iron in them), it tends to promote the reaction more. Averaging out the CO_2/CO ratios of units using synthetic and those using natural catalyst, those with natural catalyst would be 0.5 per cent higher than the average for synthetic.

Particle size might enter into this CO_2/CO ratio from this standpoint: coarse catalyst tends to increase bed density. Decreasing the average particle size of the catalyst tends to raise the level of the bed. Then it is just a question of better contacting of the particles of carbon in the catalyst with the air, resulting in better regeneration.

Q. What other comments are there on CO_2/CO ratio and afterburning?

A. The major factors in controlling CO_2/CO ratio are the catalyst activities, or the surface character of the catalyst plus any metals that might be in the catalyst itself. For example, fresh synthetic catalyst will have a CO_2/CO ratio of 1.0 approximately, equilibrium synthetic catalyst about 1.3. With fresh natural catalyst, CO_2/CO ratio will be in the neighborhood of 1.86; with used natural catalyst, it might get as high as 3.

The primary difference between natural and synthetic catalyst is the amount of iron in natural catalyst; the synthetic catalyst is essentially pure. This is further brought out by Filtrol's latest highly acid-treated catalyst having a low iron content. The resulting CO_2/CO ratio is between those for regular Filtrol and synthetic. The reason the CO_2/CO ratio in synthetic catalyst drops with increased use is loss of surface area.

Afterburning is probably one of the biggest bugaboos in the fluid process. Among the various ways to prevent it and stop it are:

1. If the unit is operated with extremely low O_2 content in flue gases, it is very doubtful that afterburning will occur. Temperature has an effect on the point where afterburning starts. Theoretically, it can be calculated. Perhaps one can operate at 1,100° F. with 3 per cent O_2 and stay out of the inflammability limit. However, at 1,100° F. and 3 per cent O_2, afterburning may occur most any time. In the past it has been standard practice when afterburning occurred to put it out by injecting a large amount of water to bring temperature level down. But unless other operating conditions are carefully controlled, the unit may reach afterburning conditions again in short order. Units have operated for hours with temperatures above the maximum chart indication.

2. The most efficient way to put out the fire is to lay down more coke. That will put out a fire a lot faster than water sprays. Increase the feed rate, or increase carbon laydown by any means available, then continue to operate. Immediately after an afterburning stage, the unit is likely to go into a period of high carbon deposition. The two of them go hand in hand. And although most operators do not like to change feed rates under such conditions, it is still perfectly sound to do so. It has been done successfully many times.

3. Another way to relieve afterburning is to put in some torch oil; however, some operators oppose this procedure. Other people believe in changing the air rate. But upsets can result from changing operating conditions of a big centrifugal blower. Thus the easiest way to prevent afterburning is to keep oxygen content down at all times.

4. Afterburning can occur in a coarse-catalyst system, even though the stack shows low oxygen. It will begin ahead of the cyclones, immediately above the bed. It will never occur in the bed itself because the bed is there to absorb the heat. But with coarse catalyst, where there frequently are large air bubbles passing through, concentrated zones of high oxygen content can occur. When afterburning occurs in this manner, the most effective ways to combat it are to keep the air rate constant and increase the feed rate, to increase the recycle rate, or to use any other means by which more coke can be laid down. Care must then be taken to prevent high carbon buildup, which in turn requires a cutback on the feed.

Q. To prevent afterburning, what limits should be set on regenerator temperature and oxygen content of the flue gas? What is the experience relative to the use of oxygen recorders to control afterburning?

A. It was attempted to control oxygen in flue gas under 1 per cent. In this particular case, a Hays recorder was used with favorable results. For good recorder results: (1) keep the temperature of the gas to the recorder below 120° F.; and (2) keep liquid water and catalyst out of the system.

As for temperature and oxygen content, keep the regenerator temperature below 1,130° F. and the oxygen in flue gas below 0.5 per cent. Remember, though, that utilization of air and contact between air and catalyst (catalyst level and particle size) are also important. The use of water sprays is believed to be preferable to reducing air.

The Hays recorder in present commercial use does not help much below 0.5 per cent O_2. Mention was made of the Ranorex recorder exhibited at the 1954 I.S.A. meeting. This instrument is accurate to 0.1 per cent or less and operates on the gravity-balance principle. It could have some possibilities for this application. The flue gas to the Hays recorder may be water washed with only slight loss of about 0.02 per cent.

Q. What maximum regenerator-bed temperatures are set and how are these temperatures controlled?

A. One refiner reported temperatures of 1,150-60° F. in the dilute phase and 1,140° F. in the dense phase. Another gave the range of 1,100° to 1,150° F. It was stated that some attempt was made to control the temperature on catalyst circulation and that, within limits, catalyst circulation and coke laydown were controlled.

Heat-Balanced Unit

Q. In F.C.C. operation, what is the most effective method for removing heat from the regenerator (excluding catalyst coolers)?

"There is no appreciable change in distribution with increasing catalyst-to-oil ratio"

A. The most effective way is believed to lie in catalyst circulation. In the fluid process, we can remove more than 70 per cent of the coke's heat of combustion by transferring catalyst out of the regenerator into the reactor.

Q. In a fluid unit not equipped with a furnace—a heat-balanced unit—is it practical to add a furnace? How can unit capacity be increased? What about methods of heat removal other than adding a cat cooler?

A. One particular unit was built without a heater and none has been added. The unit runs without heaters or catalyst coolers. In the past 3 years, however, feed-preheat temperatures have been increased 200° F. to nearly 400° F. This has been done by liquid exchange and vapor-liquid exchange on various streams.

A stream of heavy cycle oil from the cat fractionator is used as the cooling medium in the reactor, and the cat recirculation system serves as the cooling medium in the regenerator. It is an indirect approach to the proposition of taking heat out of the plant, but it's a pretty effective way at that. Throughout capacity has been increased by an increase in feed preheat. The coke make at a given conversion pretty definitely comes down, probably as a result of a lower cat-oil ratio (lower cat circulation rate per barrel of fresh feed to the unit).

Operation of three other fluid-type units has borne out these conclusions. Means employed for increasing heat removal from a regenerator are given in the approximate order of decreasing desirability (cat coolers are included, though excluded by the question):

(a) Increased recycle has first place, for improved yields usually are an added result. Limitations are usually in the fractionation equipment, although reactor (and cyclone) velocity may be critical.

(b) Cat coolers. Investment cost and possible poorer air distribution in the regenerator are the drawbacks.

(c) Higher flue-gas heat content. Assuming air input is up to maximum, this can only be done by increasing regenerator temperature. Disadvantages include deactivating and frequent trouble with afterburning.

(d) Lower feed temperature, which increases regenerator load per barrel cracked.

(e) Water spray, undesirable because of increased catalyst loss, deactivation, and probable operation difficulties or maintenance.

(Editor's Note: For discussion on heat balance units and on feed preheat, see The Oil and Gas Journal, January 10, 1955).

Catalyst-Oil Ratio

Q. What has experience shown about the catalyst-oil ratio based on fresh feed vs. gasoline yield, gasoline quality, and product distribution? This would be at a total to fresh feed ratio of 1.5. Considering all factors, what is preferable, a high or low catalyst-to-oil ratio? Why?

A. As catalyst-to-oil ratio increases, carbon laydown increases (at the same conversion). This is not an independent variable in the heat-balance unit, but a function of the heat balance. Use of a cat cooler leads to higher capital investment.

A ratio of 1.5 is the maximum; otherwise, there is more catalyst wear and tear on the unit. Severity must be achieved otherwise. For moving-bed—new units can have 4, 5, or 6 to 1 cat/oil ratio, older units 1.5 or 2 to 1—Houdry says there is no appreciable change in product distribution with increasing catalyst-to-oil ratio.

Q. Are there any data on catalyst losses on continuous versus intermittent rapping in Cottrell precipitators?

A. Experience has shown that intermittent rapping, three times each shift, is satisfactory.

Q. What is the relation of density and standpipe size for constant catalyst loading and aeration? For varying aeration? What will happen to the density just above the slide valves as standpipe size is increased?

A. Density of catalyst is a function of velocity . . . as velocity in the line increases, density decreases. If standpipe diameter is increased for the same amount of gas flow, velocity is decreased . . . gives increased density.

Catalyst Activity

Questions:

1. What problems have been encountered in catalyst-activity maintenance on fluid cat crackers, and what have been the causes of these problems and their solutions?

2. What is known about the activity of catalyst fines in the range of zero to 20 or 30 μ? What test methods were used to separate the fines, and how was activity determined?

3. Has anyone experienced a decrease in cat cracking unit activity as stack loss decreased because of holding fines in the system?

4. What experience have you had with changes in M. S. catalyst activity when using air vs. steam in the regenerator standpipe?

Answers:

Catalyst activity maintenance is a big problem. One of the big factors is the presence of catalyst poisons in the feed which tends primarily to give unfavorable product distribution as well as some catalyst deactivation. There is some association of catalyst activity, of course, with carbon laydown or slurry recycle. Other factors are deactivation through heat or steam, together or separately. The loss of high-activity fines from the system can be a problem. Generally, fines activity may be perhaps two to four numbers higher than equilibrium catalyst, probably because total fines-retention time in the system would be shorter than with coarser material.

As to the effect on activity of holding fines in the system rather than discarding them, this would be a function of the percentage of inventory makeup—in other words, of how many tons are being added per ton of inventory in the system. Anything done to hold catalyst in the system by not discarding fines would automatically reduce the makeup to the unit, and the activity would probably decline.

Regarding the amount of vanadium and nickel in the charge stock, rough approximation has been given for iron not to exceed 1 p.p.m., vanadium 0.4 p.p.m., nickel 1.5, and calcium 0.01. (See Petroleum Engineer, April 1954). It is hard to set definite values because it is the combination of metal that is important. (For curves on the effect of vanadium and copper, see also Petroleum Engineer, September 1951).

When your catalyst poisoning starts, hydrogen production on the unit will increase. Some of these poisons are good dehydrogenation catalysts.

In one organization, catalyst selectivity is considered of prime importance with catalyst activity second. On natural catalyst, this company withdraws about 1 lb. of catalyst per barrel of feed. The feed contains about 0.5 per cent sulfur. With natural catalyst it is considered very important to hydrate the feed. As high as 15 lb. of steam per barrel of feed may be injected. There are insufficient data to draw conclusions on the effect of air or steam in the regenerator standpipe on catalyst activity.

Slurry Recycle

Q. What is the effect of slurry recycle on catalyst activity in fluid cat cracking?

"Recycle ratio does not have an appreciable effect on the octane level"

A. Variables involved are type of feed, whether light or heavy feed, conversion level, and quantity of slurry withdrawn. If the quantity of slurry withdrawn is plotted vs. coke laydown, a parabolic curve is obtained. It will start with high coke at no withdrawal and then become asymptotic at some minimum coke point. More slurry may be withdrawn when using heavier feeds before the asymptote is reached. Or heavy feed the curve becomes assymptotic at about 5 per cent coke. On light feed stock, it seems to make very little difference whether slurry is withdrawn because it is not a heavy slurry. The curve is almost a straight line on light feed.

Q. In fluid catalytic cracking, does total slurry recycle increase the metal poisoning of cracking catalyst for a given feedstock?

A. No. Slurry is a distillate product and contains virtually no metals. Catalyst suspended in the distillate may be poisoned with metals but the distillate does not contribute additional metals.

Recycle Gas Oil

Q. Is there any recent information on recycle-gas-oil operation of catalytic cracking units? If so, what is the best stock to recycle and how does the presence of this stock affect yields?

A. In general, the tendency is to recycle the heavier parts of the catalytic cycle stock in order to increase the yields of light cycle stock for burner oil and, at the same time, to get an increase in gasoline yield. This of course varies with different parts of the country and different marketing situations. But as far as effect of recycling in general is concerned, the higher the combined feed ratio or recycle ratio, the higher the yield of light cycle stock at a given conversion level and the higher the gasoline yield at the same time. The higher the conversion level, the greater will be the effect of recycling on light cycle oil and gasoline yields.

Cracking of heavy cycle oil (not slurry) is like cracking any other heavy stock—usually it has a poor aniline point (say 120 to 140), the yield is poorer, and octane number may be fairly good. If virgin material is available, don't charge heavy cycle oil because it gives too much carbon. Keep any high-carbon, high-gas type of feed to a minimum.

One refiner is interested in a minimum quantity of burner oil, not particularly interested in heavy cycle oils, and would like to make a fine, low-pour, light cycle oil.

In this case, the material between light cycle oil and column bottoms is certainly the best to recycle. Returning column bottoms to the reactor largely results in gas and coke make, and does not result in any increased gasoline production. This material should be taken from the system as soon and as completely as possible.

For conversions of 60 to 75 per cent, the recycle operation aids conversion and the ease with which conversion is obtained. This certainly influences the gasoline-gas ratio favorably, particularly at conversion levels in the 70-75 per cent class. This operation was without a slurry settler.

Recycle operation with solid moving-bed units may also be of interest. All the Houdriflow crackers in the country are recycling to different ratios, but they are all running recycle stock. In all cases, the recycle is the heavy cat gas oil which is essentially above the No. 2 boiling range in temperature cut, but excluding the tower bottoms (the small amount of polymer material which usually doesn't make very much gasoline, but which usually will be taken off through a little side-stripping anyway).

Reviewing briefly from published information on the temperature and constant conversion level (that is, the space rate and catalyst/oil conditions adjusted in terms of the recycle ratio used), the increase in the recycle ratio will give higher gasoline yields with less coke and less gas. At a fixed conversion level (fixed temperature again), a higher recycle ratio will give more unsaturation in the C_4 cut and the gasoline. Recycle ratio does not have an appreciable effect on the octane level.

Decant Oil

Q. What control is used to determine withdrawal of decant oil from catalytic units? What per cent on virgin feed is the amount withdrawn?

1. One operator normally withdraws 2 per cent. This is on a heat-balance unit. Material varies from 8° to 12° gravity. Another withdraws between 2 to 8 per cent of 17°-18° gravity material . . . it depends on type of feed. Carbon balance is maintained, determined by experience.

Q. What about deasphalting decant oil from the cat cracker?

A. One refinery uses solvent refining . . . extraction of decant oil to separate aromatic fractions. This is SO_2 extraction. The raffinate goes to fixed-bed recycle cracking.

Hydrogenation of cycle oil (Unifining) and slurry oils gives material equal to furfural-extracted materials. The H_2 is cheaper if a reformer unit is available, but the H_2 may be preferable for some other use.

Thermal Cracking Cat Cycle Oils

Q. What are operating conditions and yields for thermally cracking cat-cycle oils?

A. In general, thermal cracking of cat-cycle oils is common. Some information has been published by various companies. One particularly good article is in The Oil and Gas Journal, March 29, 1951. Without going into detailed discussion of operating conditions, it can be generally stated that the recycle oil should be cracked at severe conditions to produce quality products with reasonable run time.

There has been considerable trouble in some refineries in charging the cycle oil directly to the thermal cracking coil. One refiner charges the cycle stock to the evaporator as transfer-line quench. In other words, the coke-forming materials are removed in the tar from the cracking operations prior to charging the cycle stock through the thermal cracking coil. There has been a lot of trouble due to coking when this scheme wasn't practiced.

Another refiner had considerable trouble with thermal cracking of cat-cycle stock—he was charging cycle stock directly to the furnace. Transfer-line temperature was 900°-910° F., and pressure was 500 psi. Runs were of very short duration . . . in the order of 10 days or 2 weeks before they coked up stills in thermal cracking plants.

Charging a cat-cycle stock as a quench stream to the effluent from the thermal cracking coil is better. The cracker material and quench then goes through the tar separator and from there into the bubble tower where the cracking-furnace charge stock is taken off the bottom of the bubble tower. When the temperature was raised to 930°-940° F., and pressure was lowered to 300 psi., coking in the coils ceased.

Q. How late is the cycle oil put in as a quench to the effluent from the cracking coil?

A. Here is a brief rundown of the flow. The effluent from the cracking coil is at 300 psi.; cracking also is carried out at 300 psi. Fractionation system operates at about 50 psi., so a 250-psi. pressure drop is taken through

a throttling valve. In the valve, the quench material is added to reduce the temperature of the stream from the cracking furnace. The temperature is reduced from about 930° F. to 850° or 800° F., and the stream goes through a tar separator. The amount of quench determines the amount of tar produced.

The overhead from the tar separator contains a considerable quantity of cat-cycle stock that has been vaporized due to the quenching action, as well as recycle from the thermal cracking operation. In addition, virgin material is charged directly to the bubble tower. These components form the charge stock which goes through the furnace.

The material referred to which was difficult to process when charging directly to the furnace consisted of two cycle stocks, both light and heavy. The heavy cat-cycle stock was about 750 end point and 400 initial. The material with light stock had a 600 end point. If it had been a little better quality, it would have been suitable for distillate.

Both the distillate and heavy cat-cycle stock were being cracked under the same conditions. The solution to the problem at that time was to use the light material in distillate oils. The end point was cut, and the stock was treated enough so that thermal cracking wasn't necessary. Considerable time was spent trying to find out just why the stills were coking up. All types of approaches were tried.

Furnace Design Has Big Effect

Another refiner tried thermally cracking cycle oils both straight and in blended stocks. On one particularly severe test of cracking cycle oil in a well-designed, radiant-type heating coil, gasoline with a leaded rating of 86 F-1 was produced while cracking in excess of 40 per cent conversion per pass. An aromatic quench oil is desirable. Experience indicates that the furnace design and other factors have a great effect on what can be accomplished. Very heavy residuals blended with cycle stocks and aromatic extract oils have been charged, thus deeply cracking the heavy residuals. Other diluents have been successfully used.

On a severe test, 30 to 40 days of run time are used. If the unit doesn't coke up in 30 to 50 days, the maximum possibly is not being realized from the stock. A rapid burn-out procedure to decoke thermal all-welded cracking coils is used. They can be decoked in a few hours and the units are not offstream very long. Maximum conversion, rather than maximum run time, is the criterion. For best results on thermal cracking cycle and other stocks, proper furnace design and velocities are very important.

Materials of Construction

Q. What about severe erosion of cyclones in fluid regenerators? What specific type of steel is being used and what welding procedure is proving most satisfactory for cyclones and internal piping in fluid cracker regenerators?

A. Why does the problem exist . . . why erosion? It is due to abnormal cyclone velocity, cyclones too small or other factors. Are bigger cyclones necessary? Use thicker, heavier steel . . . have tried acidproof linings, but not too good. Cement lining laid even with support mesh was successful. Increased velocity results if the lining is added later, but not if it was in the original design.

On cyclones and internal piping, A201 gray carbon steel is all right, or Grade 285AC, ½-in. lines with steel grating and refractory can be used. The main problem is in the lining—to get smooth flow and not disturb flow pattern. Also, cast carborundum lining is to be used but is not in service yet.

Q. To what extent has centrifugally cast bimetal lining been used in air-lift pipes on bead cat units, and what is the life span of such linings?

A. Not enough experience with this on one application in which the bottom 36 ft. is bi-metal cast chrome moly. One company has run 15 months with a whole lift pipe consisting of bimetal.

Q. Has it been necessary to internally line any catalytic cracker reactors to reduce wall temperatures and so avoid failures of reactors due to excessive graphitization?

A. No. For fluid units, use 1 per cent chrome, 0.5 per cent molybdenum alloy reactor shells. This practically eliminates the problem of internal lining to avoid graphitization. None of the moving beds is lined.

Q. Are there any monolithic lined or alloy catalyst standpipes in service? If so, are they giving good service?

A. Many Fluid-unit operators have alloy standpipes of low-alloy carbon steel. They do fine . . . no erosion problems.

Another refiner has some inside-lined standpipes. But repairing the lining has become a bottleneck many times on turnaround. A low chrome-moly or perhaps just 0.5 per cent moly will give a very good service where standpipes are concerned.

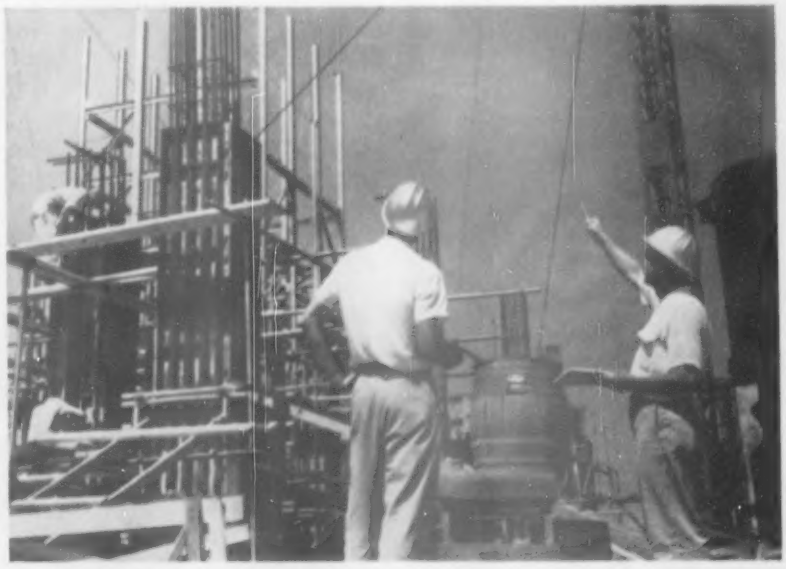
The earlier U.O.P. war-time units of course had lined standpipes. But after the war, low-alloy standpipes were employed, particularly in the regenerator standpipe where the temperature is high.

Q. Has monolithic lining been used to replace refractories in fluid cat **cracker regenerators?**

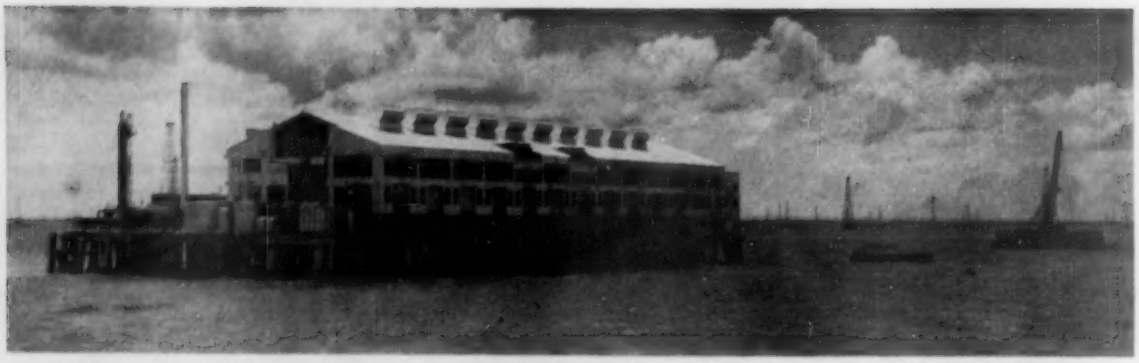
A. Since the Aurora unit was installed in 1947, monolithic linings have been used in regenerators very extensively and successfully.

Q. How can gunite linings be installed to prevent plugging of valves in the regenerator standpipe in event of regenerator-lining failure?

A. It can't be done. The best insurance against valve plugging is to properly anchor, cure, and dry the lining.



CAT-CRACKER CAPACITY continued to increase throughout the country in 1954. Shown here is view of Shell's Norco, La., unit during early stages of construction.



BUILT 7 miles offshore, the new plant was designed to inject 137 M.M.c.f.d. of gas into the producing formation.

Creole Completes Gas-Injection Plant

Lake Maracaibo operation expected to increase oil production 50 per cent

COMPLETION of its conservation plant Tia Juana No. 1 by Creole Petroleum Corp. marks the first major step toward economic utilization of the gas produced in Bolivar Coastal field of Venezuela.

Located 7 miles offshore and built on a platform over the waters of Lake Maracaibo, the plant is unusual in many respects. It is the result of 4 years' intensive and detailed study by Creole engineers.

As a result of the operation of the new plant, the following major benefits are expected:

1. Natural flow. The wells in the area will continue to produce by natural flow.

2. Gas. A large volume of gas will be conserved.

3. Oil. Producing rates of the field will be increased by nearly one-half.

4. Ultimate recovery. The amount of oil recovered from the reservoir will be increased by about one-third.

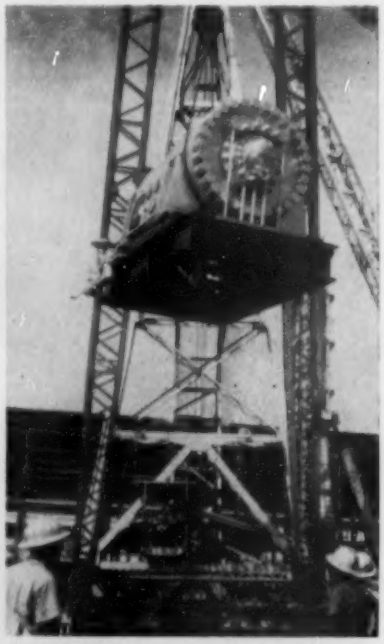
Gas capacity . . . The project is designed to gather 154 million cubic feet of gas daily from the producing wells in the LL-370 area. From eight nearby flow stations, where the gas is separated from newly produced oil, it is carried to the new plant through five 30-in. pipelines at 25 psig.

Some 17 million cubic feet of the gas will be used as fuel and condensed to liquids. The remaining 137 million cubic feet will be compressed to 1,935 psig. and returned through five injection wells to the producing formation. Injection commenced in October.

Plant Design Details

The predesign study indicated that the gathering of the gas to a gas combustion-turbine powered centrifugal-compressor station, in the weighted center of the field, was preferable on all counts. The decision to use such a system was quite progressive since experience with gas-fired combustion turbines was limited, and at the time no large installation of centrifugal compressors had been made for compressing natural gas above 1,000 psig. On the basis of the studies, the project was held to be feasible and economically attractive.

The installation of a gathering system to handle large volumes of gas at low pressures was one of the unusual problems that had to be overcome. The gathering system lies on the lake floor at depths of from 62 to 65 ft. Based on optimum pressure drop, the economic line sizes were determined as ranging from 24 to 30 in. diameter. Some 65,000 ft. of 24, 26, and 30-in. pipe were actually laid.



ONE OF THE TEN centrifugal compressors installed in the plant is swung into position during construction. Each is powered by a 6,000-hp. turbine.

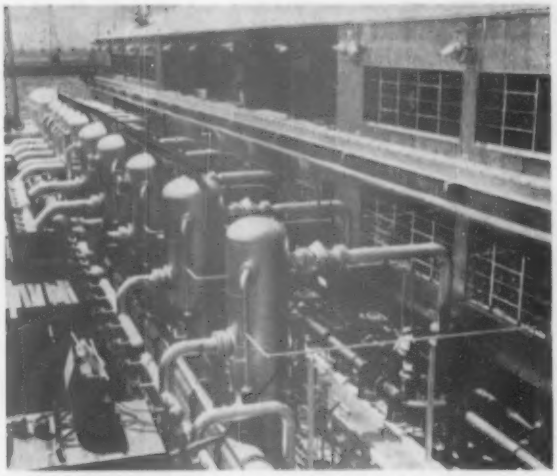
Protection of the underwater pipe against the corrosive effect of the brackish lake water and the teredos (marine termites) that exist there, plus the necessity for added weight to secure a negative buoyancy, required special preparations. The system devised was to coat the pipe with asphalt, wrap it with glass cloth and then with heavy wire mesh, and then to cast some 4½ in. of concrete around it. This provided an average negative buoyancy of 15 per cent. The preparation and placing of this extremely heavy pipe (562 lb. per foot for 30-in. pipe in sections up to 1 mile in length) in 62-65 ft. of water was in itself a major undertaking.

The fact that lines of such large diameter could not successfully be cleaned by flowing, that the interior pressure of the gas would be less than the exterior water pressure (with the consequent entrance of water on development of breaks or leaks), and the impracticability of installing and operating "line drips," required extensive measures to prevent the entrance of liquids into the gathering lines, and to remove such liquids when inadvertently admitted.

Compressor Plant Equipment

The compressor plant consists of 10 General Electric, 6,000-hp. two-shaft gas turbines each direct connected to 10 specially designed and constructed

SEVEN STAGES of compression provided by these 10 compressors raise the gas to a pressure of 1,935 psi.



THIS LINE of scrubbers removes impurities from the gas prior to its passage into the compressors.

Ingersoll-Rand compressors. Seven stages of compression are provided.

The first compression stage requires the capacity of three compressors connected in parallel to handle the large gas volume at the low plant intake pressure (25 psig.).

Two parallel-connected compressors form the second stage, while the remaining stages have one compressor each. Intercooling and interstage condensate facilities are provided between each of the stages. Provision is made for the interstage condensate to be stabilized and pumped to the nearest flow station for blending with crude.

The high-pressure gas going to the injection lines is cooled after leaving the seventh-stage discharge. Entrained or condensed water is removed at this point to lessen corrosion which might result from combination of the water with carbon dioxide contained in the gas, and to prevent slugs of water from returning to the formation.

Turbine Compressors . . . The 10 two-shaft turbine drivers, selected to secure maximum flexibility in speed variation, represent the largest concentration of gas-combustion turbines in the world. The turbine air compressor will operate at 7,500 r.p.m. and the power rotor normally at 5,400 r.p.m., with "overspeed trip" at 6,000 r.p.m.

The first five compressors are cast-iron split-case type, the next three are forged-steel split-case type, and the last two are steel-barrel type. Any single turbine-compressor unit can be isolated from the system without shutting down the plant. The estimated decrease in throughput with a compressor out of service will vary from 8 per cent for a first-stage compressor to some 25 per cent for a sixth or seventh-stage compressor.

Control equipment for the plant is designed to take care of the multiplicity of coordinated and interlocking steps required to start and operate its high-speed machinery, to protect each compressor from surge conditions, to isolate immediately a faulty turbine-compressor unit from the system and to secure a maximum of safety. Three of the four major control systems work in conjunction with each other in interacting and/or overriding manner, while the fourth is a three-way pressure-relief system. Aided by this extensive instrumentation, the compression system will permit operation of the plant with a minimum of personnel and at greatly reduced maintenance costs, when compared with a conventional reciprocator-type plant. One of the largest savings foreseen is in the decreased use of lubricating oil.

The plant is well equipped with an instrument shop, a mechanical maintenance shop for small work, six offices, change-shower rooms, and a dining room. Communication with the shore is by radio-telephone and through the plant itself by an intercom system.

Character of Producing Formation

The productive horizon into which gas will be injected was discovered in 1939 by well LL-370 and is composed of the B-6-X Eocene sands. The subsurface reservoir is a permeable rock section saturated with oil and about 200 ft. thick, consisting of 85 per cent sandstone and 15 per cent shale. The top of the oil reservoir, at 4,500 ft. below the lake surface, is sealed off by the Miocene-Eocene unconformity and the bottom is bounded by immobile edge water at 5,850 ft. Two large faults define the side boundaries. The structure dips a gentle 3° to the southeast and the total productive area involved is approximately 9,800 acres.

This sand deposit is similar to all major oil accumulations in Bolivar Coastal field in two characteristics: (1) It has no active water influx at the bottom, and (2) it originally had no gas cap at the top. Production during the early years was entirely by solution gas drive. A secondary gas cap formed in 1950 by gravitational segregation reached the structurally highest wells. It was apparent that even without artificial pressure maintenance, considerable increases in oil recovery above that to be expected by dissolved gas drive could be obtained by assisting the gravitational segregation and secondary gas-cap development. In short, the reservoir was performing efficiently as a natural gas-oil system except for the declining pressure and accompanying undesirable changes in fluid properties.

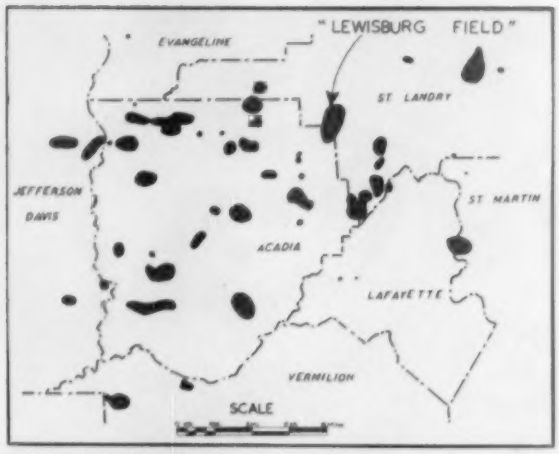
Core data . . . During the development of the reservoir, the importance of obtaining cores from the productive formation was recognized, and in many wells cores were obtained throughout the productive interval. Characteristics of porosity, permeability and fluid saturation were determined. All properties of the reservoir fluids were checked to obtain accurate data on the oil characteristics. Analysis of all this information was the initial step undertaken by Creole 4 years ago. In view of the complicated reservoir calculations involved and variations in the producing sands' characteristics and fluid content, estimation of the recoverable oil under various development programs required 10 man-years of work.

Behavior of the deposit in future years was estimated under three different conditions: (1) production by natural forces, (2) production by pressure maintenance with gas injection, and (3) production by pressure maintenance with water injection. Gas injection was decided on as the most advantageous.

PROGRESS REPORT:

Lewisburg Typifies South Louisiana Multiple-Pay Fields

Some new concepts of lower Frio section may result from studies of developments in this field



LEWISBURG FIELD lies astride the Acadia-St. Landry Parish line, southern Louisiana. Fig. 1.

by Ray Ocamb and Robert P. Grigg, Jr.

THE Lewisburg-South Lewisburg field is located 15 miles northwest of the town of Lafayette in the east part of Acadia and the southwest part of St. Landry parishes, in Louisiana. Access to the field is by secondary all-weather gravel roads. Fig. 1 shows the regional location of the Lewisburg-South Lewisburg structure as well as its relationship to surrounding fields.

Topographically, the field area is flat with occasional eroded depressions resulting from rainfall drainage. Ground elevations average slightly over 55 ft. As is normal for fields in the surrounding area, the subsurface structure is not reflected at the surface.

History of Discovery and Development

The Lewisburg structure was localized as an "interesting anomaly" by torsion balance and reconnaissance reflection geophysics in 1937. A more detailed reflection survey in 1940 led to the drilling of the discovery well, Stanolind Oil & Gas Co. 1 Tweedel, completed December 10, 1941. This well was completed as a gas-condensate producer from the Tweedel sand in the interval 10,140-50 ft. A confirmation test was completed 4,000 ft. east of the discovery well in March 1942, and production was extended 1½ miles to the north in June 1942. The first well for South Lewisburg field was completed in September 1943. At the time of this writing 29 producers and eight dry holes have been drilled within the field area.

Authors are with Winray Petroleum Corp., and Tide Water Associated Oil Co., Lafayette, La., respectively.

This paper was presented at the fourth annual meeting of the Gulf Coast Association of Geological Societies in Houston, November 1954. It is presented here by permission of the G.C.A.G.S.

The producible limits of the field, particularly in reference to the deeper beds, have not been established in the south fault blocks. Development continues in the field with one or two rigs in nearly continuous operation.

Stratigraphy

General . . . Lewisburg-South Lewisburg field is located in the Marginulina-Frio trend of producing fields of the middle Gulf Coast. A general stratigraphic section for the field is shown in Fig. 2. The Miocene-Oligocene contact as shown is based on certain paleontological markers and is in more general usage in the industry than the USGS classification.

The base of the fresh-water section can be picked from electrical logs at approximately 1,100 ft. Most descriptions of the lithology of the field section are made from electrical-log reference in conjunction with coring information.

Miocene-Pliocene-Pleistocene . . . The Miocene-Pliocene-Pleistocene section in the field includes 7,000-7,500 ft. of sediments. It is composed of undifferentiated sands and lesser shales which locally have not been subdivided into a standard nomenclature, and which are generally considered as one over-all lithologic unit. Certain electrical-log characteristics are dependable in correlating particular stratigraphic equivalents within the section, and these characteristics are utilized for mapping purposes. No reliable faunal markers exist in this section.

Anahuac wedge . . . The Discorbis, Heterostegina, and Marginulina zones composing the Anahuac wedge have an average total field thickness of 1,400 ft. These sediments are considered Oligocene in age.

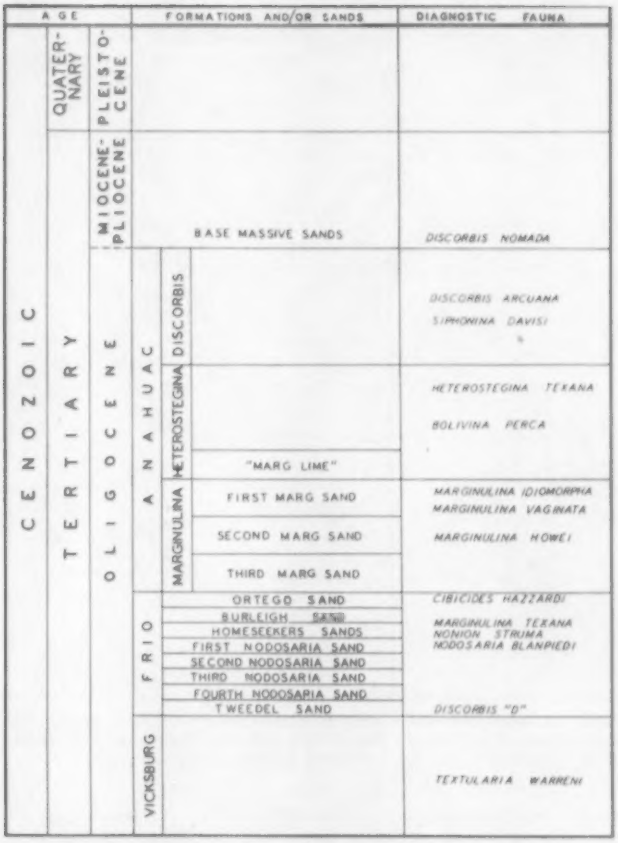
Discorbis zone . . . The lithology of the Discorbis zone is similar to that of the overlying Miocene sediments. The zone itself is thin, averaging 200 ft. in thickness, and is a transition between the massive Miocene sand beds and the shales and limes of the underlying Heterostegina zone. Discorbis nomada, a vagrant microfossil, usually is first found in the sand section immediately above the true Discorbis zone. Siphonina davisi and Discorbis arcuana are commonly identified as typical Discorbis fauna.

The Discorbis zone is unproductive in the field.

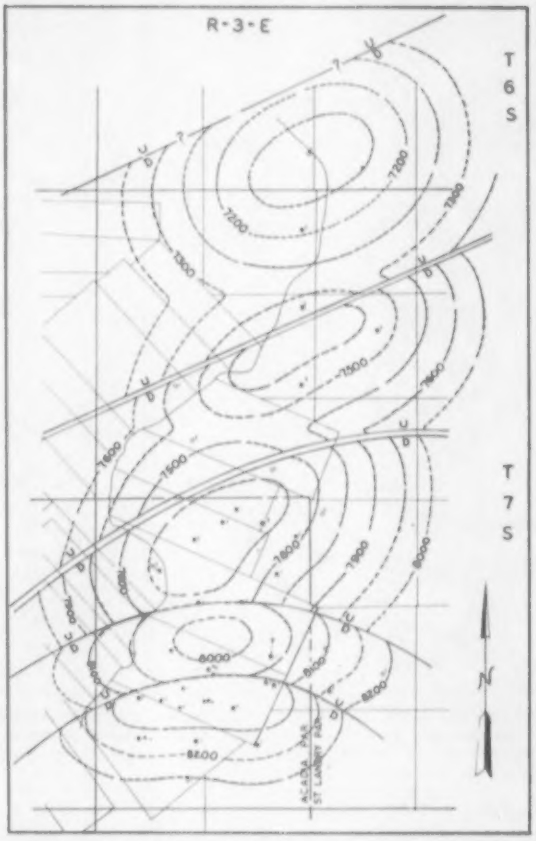
Heterostegina zone . . . The Heterostegina zone averages 400 ft. in thickness. It is composed of sand and shale in its upper part and predominately lime and shale in the bottom 200 ft. The Heterostegina limes develop similarly throughout the field and it is noteworthy that the basal lime is probably the most reliable regional electrical log marker of the trend. The limes are generally white to grey, generally hard, and from drilling and coring information, occasionally cavernous. The microfossils Heterostegina texana and Bolivina perca are abundant and typical to the zone.

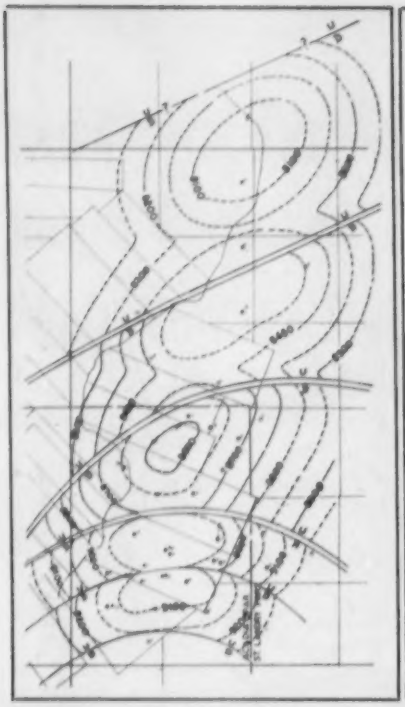
The zone is not productive in the field.

Marginulina zone . . . The Marginulina zone averages 800 ft. in thickness and is usually composed of shale breaks between rather thick, brokenly developed sands. There is a tendency toward limyness in most of the sands. The microfossils Marginulina idiomorpha,



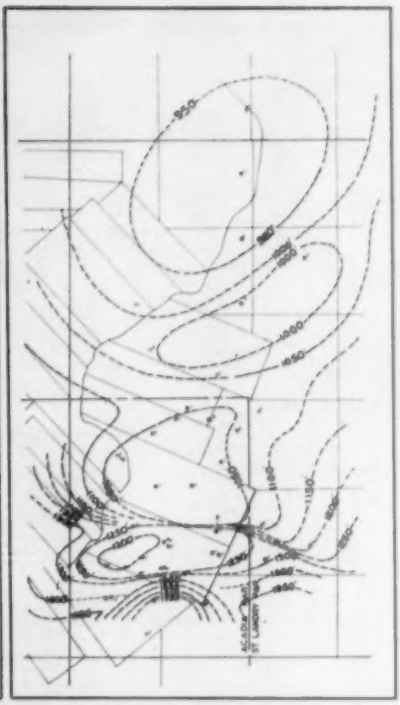
STRATIGRAPHIC COLUMN for Lewisburg area; column on right reveals key foraminifera. Fig. 2.





SHARPENING OF STRUCTURE with depth is demonstrated by contours on approximate top of Frio at Lewisburg. Fig. 4.

ADDED COMPLEXITY of fault pattern is shown in structure map contoured on top of first Nodosaria sand at Lewisburg. Fig. 5.



ISOPACHOUS MAP of sand interval between Frio and first Nodosaria sand reveals effects of faulting in area. Fig. 6.

Faulting . . . All faulting in the field is normal, downthrown to the south, with dips varying from approximately 45° to 55°. Fault throws, greatest in the deeper beds, gradually decrease and disappear in the shallow Miocene massive sands. Most faults strike curvingly across the structure so that they are concave toward the south. There is a development of reverse dip into the fault plane resulting from the contemporaneous action of fault movement and sedimentary deposition. This reverse dip, common in South Louisiana fields, increases with depth, particularly in the south fault blocks of the field.

Fig. 3 is a structural interpretation of the field as contoured on the base of the Marginulina or "Marg" line. The configuration of the structure at this datum is strikingly similar to that of the deeper horizons. The separating faults of the field are already well developed and the strike pattern, moving from north to south, shows increasing curvature toward the south. The greatest expression of structure appears to center in the middle fault block on this horizon where there is the most reverse dip into the northbounding fault as well as the largest fault throw. The most southern fault block has north dip only in a rather narrow area immediately downthrown by the northbounding fault. A small fault, encountered at depth in the most southern well in the field, is not shown.

Fig. 4 is a structure map contoured on the approximate top of the Frio. There are a noticeable sharpening of structure, greater reverse dip, and greater fault throws on this horizon than were seen on the Marg lime, and an additional fault, the most southern fault in the field, is reflected on this horizon. The axis of the structure has not shifted though the individual fault block closures have moved southward in accompaniment to the southward migration of the faults with depth.

Fig. 5 is a structure map contoured on top of what the authors prefer to call the First Nodosaria sand. The correlative tops in the south two fault blocks relative to the rest of the field are not generally accepted in the industry. It is the correlative problem from this datum down through the deeper beds which has occupied the authors most in the preparation of this paper. This matter is treated in detail later in the report.

The structure continues to sharpen on the First Nodosaria sand horizon. In the south two fault blocks, dips average 350 ft. to the mile as compared to 150 ft. to the mile on the Marg lime datum. Though control is limited, dips in the north fault blocks of the field have not changed. This may suggest a period of stability in the north part of the field quite in contrast to the instability reflected by the active fault movement in the south part of the field. The fault throws in the south part of the field have increased rather dramatically with a resultant increase in section thickness. A small split fault, not seen on the more shallow maps, is evident on the east flank of the field. The faults continue to curve back more sharply to the south.

Fig. 6 is an isopachous map, with all faulting restored, of the interval between the top of the Frio and the top of the First Nodosaria sand. This map depicts clearly the importance of the various field faults in controlling the thickness of the Frio section. Even though the faults are not shown it is still possible to follow their strike by simply tracing through the field the bands of greatest thickness. The relatively greater importance of the most southern field faults in influencing the Frio sediments is better understood from a comparison of the intervals in the different fault blocks. Average intervals moving from north to south for the various fault blocks or closed areas are 925 ft., 975 ft., 1,050 ft., 1,225 ft., and for the most southern area, 1,750 ft. The average thickening for 5 miles southward from the north end of the structure is only 125 ft., whereas for the next mile on southward across the two most influencing faults it is 700 ft. The many close-spaced lines near the south end of the structure are 50-ft. isopachous lines which pipe up so closely along the fault zone that they cannot

be carried across the structure without becoming one solid line.

Fig. 7 is a map of Lewisburg field showing the location of cross-section A-A' which is illustrated in Fig. 8. This cross-section shows the following: normal type, down to the south step-faulting, cutting the structure; numbered lines of correlation with key of reference for the important field horizons; increase in fault throws with depth; moderate thickening of section in the shallow beds as compared to extreme thickening in the deeper beds moving from north to south; reverse dip into the downthrown side of the faults, increasing with depth, and lower Frio section in the north fault blocks that is as yet untested in the south fault blocks.

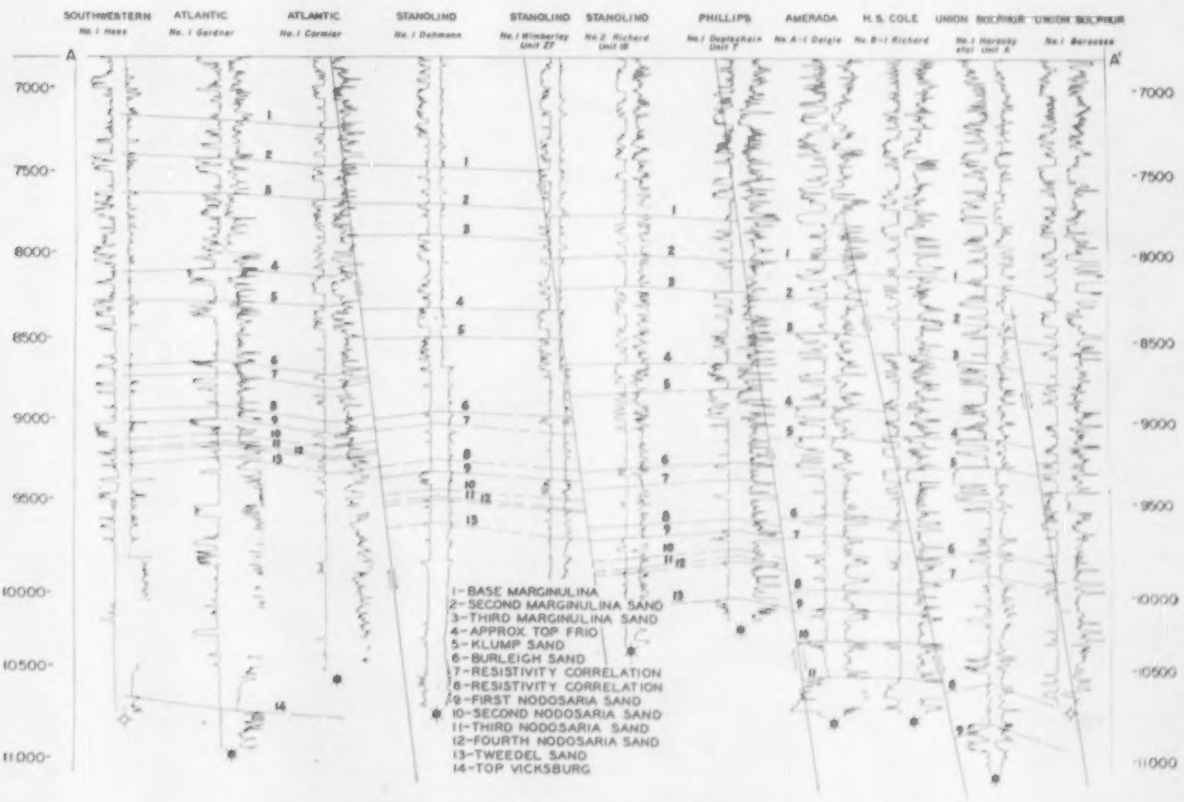
An intimate study of all available geologic information in Lewisburg field in conjunction with other information provided by recent deep drilling in surrounding areas, suggests that at least a new set of correlations and possibly even a new concept of the entire geology of the lower Frio in the Lewisburg region is warranted. If the correlations of the lower Frio section offered here are correct, or even nearly so, it becomes apparent that new concepts concerning depth estimates, thickness of section, prospective pays, and genesis of structure relative to the lower Frio are necessary.

It seems only reasonable in face of the evidence that the action of one large strike fault or a series of strike faults is the most influencing factor in determining the characteristics of the lower Frio section in the Lewisburg area. This faulting probably borders along the south a competent, relatively positive area of lower Frio or Vicksburg age which is of regional significance all along the trend. The faulting itself seems to exist along a so-called "hinge line" where a great increase in dip of the lower Frio beds, when considered irrespective of fault block thickening, suggests an embayment or area of thick deposition located to the south.

Producing Reservoirs

General . . . With the exception of one small oil reservoir, all production in Lewisburg field is gas condensate. Eight Frio sands, constituting 12 separate reservoirs, have produced approximately 2,700,000 bbl. of oil and condensate and 55 billion cubic feet of gas. In addition, several middle Frio sands in the south fault blocks of the field have not as yet been produced. The gas reservoirs have been unitized on approximately 160-acre spacing. The divisions of interest in the units for both

ORIENTATION of cross-section shown in Fig. 8 is demonstrated here. Fig. 7.



CROSS-SECTION A-A' north-south across Lewisburg field. Fig. 8.

the operators and royalty owners are based on surface participation rather than on an acre-foot basis. It is generally accepted that a gas-expansion drive and a water drive are both in effect in most of the producing reservoirs.

9,100-ft. sand . . . The 9,100-ft. reservoir, a thin 10-ft. sand, has been produced in only one well, the Stanolind 1 Dohmann. It is not developed in surrounding wells and as it has been abandoned after producing only 38,600 bbl. of condensate and 400 million cubic feet of gas, it is conceivable that accumulation may be related more to the development of the sand itself than to structural conditions.

Lower Homeseekers sand . . . The Lower Homeseekers reservoir, a brokenly developed sand approximately 30 ft. thick, is the source of all production in the most southern fault block of the field. It is a fine-grained, slightly calcareous sand which tends to shale up moving off structure. Approximately 200,000 bbl. of condensate and 6.4 billion cubic feet of gas have been produced from the sand.

First Nodosaria sand . . . The First Nodosaria sand produces in the next to the most southern fault block of the field. It is composed of two members, the lowermost of which shales out moving eastward. There is a noticeable increase in sand development moving into the downthrown side of the fault bounding the reservoir on the north. There is over 250 ft. of producing relief on this sand. The reservoir has produced over 350,000 bbl. of condensate and 11.9 billion cubic feet of gas.

Second Nodosaria sand . . . The Second Nodosaria sand is producing from only one well, the Amerada 1 C. D. Daigle (Unit E-1). It is a firm, medium-grained calcareous sand composed of two members in an over-all section of 50 ft. It has produced approximately 200,000 bbl. of condensate and 3.2 billion cubic feet of gas.

Third Nodosaria sand . . . Most of the production from the Third Nodosaria sand is limited to the next to the most southern fault block in the field. It is a soft, medium-grained, grey, glauconitic sand averaging 100 ft. in thickness. It has been named and unitized as the Tweedel sand, but in keeping with the nomenclature offered in this paper, it is treated here as the Third Nodosaria sand. It has produced 300,000 bbl. of condensate and 4.7 billion cubic feet of gas.

Lower Third Nodosaria sand . . . This reservoir has produced all the oil for the field; approximately 450,000 bbl. It is a thin, medium-grained, soft glauconitic sand which appears to shale out updip on structure, and in so doing, becomes a stratigraphic trap. It is of limited volume and is being rapidly depleted.

Tweedel sand . . . The Tweedel sand is the most prolific reservoir in the field, having produced approximately 1,150,000 bbl. of condensate and 26.5 billion cubic feet of gas. Nearly all Tweedel sand production is obtained from the middle fault block of the field. The sand is soft, gray, medium-grained with thin calcareous streaks throughout and a hard, calcareous zone in the top. Porosities average 33 per cent and permeabilities average 875 md.

Other reservoirs . . . The Atlantic 1 Gardner produced a small amount of gas and condensate from a stray sand developed immediately below the Tweedel equivalent. Small noncommercial quantities of gas and condensate were recovered on several tests of other Frio sands.

Reference

1. C. L. Aycock, "Geology and Genesis of the Bosco-Cankton-Shuteston Structural Complex," unpublished paper.

BOOKS

CATALOG OF HEARINGS ON SOUTH LOUISIANA OIL AND GAS FIELDS. Published by F. E. Zimmer & Co., 608 American Bank Building, New Orleans. 72 pp. Available on request.

This is a catalog of hearings held in the past 5 years on the South Louisiana oil and gas fields. These hearings are the testimony presented to the State of Louisiana by oil companies and other interested parties and contain much valuable information on the various producing fields. The catalog lists the individual hearings alphabetically by field and parish and indicates type of exhibits contained in each hearing, as well as the applicant submitting the testimony and the purpose of the hearing.

SUBSURFACE STRUCTURE MAP OF THE UINTAH BASIN IN UTAH AND COLORADO. Published by Austin Map Co., 415 Bewley Building, Fort Worth. $15 (paper), $25 (cloth).

This geologic map is on a scale of 1 in. to 8 miles and the map dimensions are 36 by 60 in. Major structural trends are clearly shown, as well as key wildcats. The map is contoured on the Dakota formation with a 500-ft. contour interval for western Colorado and on the Chinle formation for the Utah. The map covers the Colorado plateau, an area that is of interest to the uranium industry as well as to the oil industry.

TULSA GEOLOGICAL SOCIETY DIGEST, Vol. 22. Available from Digest Business Manager, Tulsa Geological Society, Box 263, Tulsa. $2.

As in previous issues, subjects of timely interest to geologist, geophysicists, engineers and oil men are presented. More than abstracts, these articles are digests of talks given before the society during the 1953-54 season. A partial listing of the contents includes formation logging, artificial formation fracturing, plus articles of general geological interest. Area studies include southern Oklahoma, the "Four Corners" region, Gulf Coast, Wyoming, Utah, Nevada, and Mexico. Continuing its policy of presenting scholastic contributions, the digest this year includes, from the University of Oklahoma, a complete list of all geological theses from 1904-1954.

GEOLOGY OF COSHOCTON COUNTY, OHIO. By Raymond E. Lamborn. Columbus, 1954. Division of Geological Survey, Room 106, Orton Hall, Ohio State University, Columbus 10. 245 pp. and maps. $3 plus 9 cents tax in Ohio.

This volume presents a physical description of the sequence of rocks in Coshocton County which includes sandstone, limestone, clay, and coal, with an explanation of their economic utilization. John H. Melvin, Chief of the Division of Geological Survey, points out that the issuance of this publication at this time is of particular interest because of the current activity in exploration for oil and gas in the western part of the county.

GEOLOGY OF PETROLEUM. By A. I. Levorsen. Published by W. H. Freeman & Co., San Francisco. 703 pp. $8.

Both active petroleum geologists and advanced geology students will find this book a handy summation of the most important techniques for interpreting geologic and geophysical oil-exploration data. Ranging over every phase of petroleum geology from structures to reservoir engineering, the text is concentrated on data interpretation rather than accumulation. It is very ably illustrated by more than 300 up-to-date maps, charts, and sections. In short, this test fully meets the author's chief objective of "pointing out the kind of evidence, the principles, and the ideas that should prove to be the most helpful in the discovery of petroleum."

THE CHEMISTRY OF PETROLEUM HYDROCARBONS, Vol. 1. Edited by Cecil E. Boord, Stewart S. Kurtz, and Louis Schmerling. Published by Reinhold Publishing Corp., 430 Park Avenue, New York 22. 664 pp. $18.

Compiled with the aid of 60 contributors, this series presents a complete range of information on the scientific fundamentals of hydrocarbon chemistry. Major emphasis is placed on the basic chemistry of the hydrocarbons themselves. However, many industrial processes involving hydrocarbon chemistry are described and several chapters discuss probable mechanisms of hydrocarbon reactions and the physical methods of studying the structure of complex petroleum hydrocarbons.

Chapters are devoted to the various hydrocarbons in natural gases, in the middle-distillate range, in lubricating oils, and in petroleum waxes. Types of crude, composition of shale oil, and origin of petroleums are covered in other chapters.

BULLETIN OF THE SOUTHWESTERN ASSOCIATION OF PETROLEUM GEOLOGISTS, Vol. 1. Originally published in 1917, reprinted by Cambe Log Library, 328 Esperson Building, Houston. 159 pp. $10.

An interesting project of private reprints of the early bulletins of the Southwestern Association of Petroleum Geologists, later the American Association of Petroleum Geologists. Originally, only 250 copies of this first volume were printed, and they are now collector's items. Cambe Log Library will reprint Vol. 2 as the next in this series and will continue to reprint later volumes, depending upon acceptance.

How Can You Reduce Maintenance Costs On Electric Beam-Pumping Motors?

Phillips did it by selecting equipment carefully and maintaining it through a well-planned program. Comparative results? A maintenance cost of $3.25 per motor per month for an area that used this approach—against a cost of $6.30 per unit for a similar area that didn't.

by T. L. Scott

THE three-phase electric motor is a rugged, dependable prime mover for oil-field service. It has only two parts subject to wear or deterioration, the bearings and the winding. Experience shows that the average operating life of these parts is generally greater than 10 years. In view of this, it might be assumed that the use of electric equipment to operate beam-pumping wells would result in low maintenance costs regardless of the type of equipment used. However, this is not the case. Maintenance costs actually vary as much as 200 to 300 per cent.

Quality, low-cost maintenance is primarily dependent upon the following:

1. Proper selection and installation of equipment.
2. Realistic measurement of maintenance requirements.
3. Complete organizing and scheduling of maintenance operations.

To consider how maintenance costs can vary, consider the electric-maintenance costs for two different areas:

. . . **Area 1** consists of 167 beam-pumping motors, 44 transformer banks, and 42 miles of line. All installations conform with present company standards. The average motor age is 4 years. During the last 8 years, the area has accumulated 668 motor-operating years with three winding failures. The present average maintenance cost for motors, controls, service connections, lines, and transformer banks is $3.25 per month per motor. Included in this maintenance cost are material, labor, and transportation.

. . . **Area 2** consists mainly of older, nonstandard electric installations. Climatic conditions are similar to those in Area 1. During a recent period of 30 days, six motor-winding failures occurred, at an approximate cost of $725. Five of the failures were due to lightning, and one of the failures was due to a stalled single-phase condition. The six motor failures represent approximately 1 per cent of the total beam-pumping motors in the area.

In 1944, the motor-winding failures due to lightning were more than 15 per cent of the total motors installed. In 1945, the percentage was again more than 15 per cent. Since 1945, there has been a continuous program of lightning-protection improvement which has reduced the annual failures to 3 to 4 per cent. The electrical maintenance costs for this area are approximately $6.30 per motor per month.

Though the difference of $3.05 in monthly motor-maintenance costs for the two areas may appear to be small, it becomes a very significant figure when we consider the annual maintenance cost for 1,600 beam-pumping motors. On the basis of costs in Area 1, the annual maintenance cost for 1,600 motors would be $62,400, and on the basis of costs in Area 2, the annual maintenance cost would be $121,000.

1. By proper selection and installation of equipment.

The electric beam-pumping installation consists of transformer bank, lines, service connections, controls, and motors. It is only necessary to check a few of these installations before concluding that there is considerable variation in the selection and installation of electrical equipment. This variation is not only prevalent between companies but within companies. To the person not familiar with electrical operations, it might be assumed that the practice of carefully selecting and installing electrical equipment was of little importance. However, this practice is very important, for trouble-free, low-cost electric operation begins with the proper selection and installation of equipment.

With the extensive operations of most oil companies, control of electrical installations can only be achieved through the use of standard specifications. Our use of standard specifications has resulted in lower maintenance costs. Standards are also of value when bids are being solicited for electrical work.

It would be very difficult to evaluate each standard and particularly the value of our lightning-protection standard. However, a review of the motor failures due to lightning in Area 1 and Area 2 may be of interest and value.

ANNUAL MOTOR FAILURES DUE TO LIGHTNING

Location—	Per cent of total motors
Area 1:	
With standard protection	.45
Area 2:	
With nonstandard protection	3.00 to 4.00
With no protection	15.00

It should be pointed out that the frequency of thunderstorm days per year is approximately the same in the two preceding areas. The isokeraunic map shows the prevalence of lightning storms to be 35 thunderstorm days per year in Area 1 and 40 thunderstorm days per year in Area 2. Because the isokeraunic map does not show the magnitude or duration of the thunderstorms, a direct evaluation of the value of our lightning-protection standard cannot be made on the basis of the motor failures in Areas 1 and 2. However, the negligible number of motor failures in other areas where the installations are standard and the thunderstorm frequency is 40 or more leads us to believe that the lightning-failure records of Areas 1 and 2 are a substantial indication of the value of our standard lightning protection.

Another example of the value of standards occurred in Wyoming when a stalled single-phase condition occurred in an area where we have 31 motor installations. All but two of the installations had controls which were wired according to the standard that specified that the time delay-relay coil will be wired across a different phase

Author is with Phillips Petroleum Co., Bartlesville, Okla. Paper presented at 1954 A.I.E.E. petroleum industry conference, Tulsa.

than the magnetic-starter holding coil for stalled single-phase protection. The results in Wyoming? The two motors with nonstandard wiring of the controls burned up.

2. By careful measurement of maintenance requirements.

Effective inventory control of perishable material for a processing plant is essential to efficient operation. Inadequate control results in costly material waste and production delays. Maintenance labor might also be considered a perishable material, for here, too, inadequate control results in costly waste and production delays, and money once spent for wasted labor or poor work can never be regained. Hence, for efficient operations, maintenance labor must be balanced against the actual work requirements.

Our maintenance requirements are determined by either direct-method analysis or on the basis of previous analyses and studies. The same approach is also used in selecting transportation units, tools, and equipment necessary for the efficient performance of work.

The maintenance requirements for electric beam-pumping equipment in Area 1 are shown in the following tabulation. Area 1 has the following motors: 1 2-hp., 13 5-hp., 27 7½-hp., 77 10-hp., 31 15-hp., 4 20-hp., 8 25-hp., and 6 30-hp. There are 44 transformer banks and 42 miles of line. Preventive maintenance checks are performed twice a year on motor installations and once a year on lines and transformer banks. Radius of operations is 50 miles. The requirements in the table below are typical of good operations, but they are not the lowest obtainable.

On the basis of the preceding maintenance requirements for Area 1, one electrician could take care of 272 beam-pumping motors, 72 transformer banks, and 69 miles of line where conditions were similar.

At the present time, all motors in Area 1 are given a preventive-maintenance check twice a year. This frequency is to be changed to once a year for motors of 20 hp. and less, and on this basis one electrician, where the conditions were similar to Area 1, could take care of 338 motors, 89 transformer banks, and 85 miles of line. This change will also reduce the maintenance cost from $3.25 to approximately $2.76 per month.

3. By organized, scheduled maintenance operations.

After a carpenter has carefully measured a board for cutting, he must be able to saw the board to dimensions or his measurements will have been of little use. Our problem is similar; after we have determined the electrical-maintenance requirements, we must be able to organize and schedule the work on the basis of these measurements. In doing this we have three main considerations:

1. Scheduling of work.
2. Organizing a communication system for requesting work.
3. Instructions and standard practices.

Oil-field electrical maintenance can be divided into three types of work: (1) repetitive work (preventive-maintenance checks and lubrication), (2) scheduled repair work, and (3) emergency repair work. Generally, 65 to 95 per cent of the work can be scheduled, and at least 50 per cent of the jobs are of the repetitive type which can be permanently scheduled.

In setting up our system of scheduling work, our object is to design a system that will have flexibility, a system that will not be seriously affected by the performance of repair and emergency jobs. This may be accomplished in the following manner:

1. Each permanently scheduled job is assigned a number. This number shows the order in which the jobs will be performed and determines the electrician's path of travel.
2. The repetitive type of work is then scheduled for 3 or 4 days per week. The jobs are scheduled numerically and not by time.
3. Repair jobs that can be scheduled are accumulated and performed on those days when repetitive jobs are not scheduled.
4. The repetitive job schedule is not critical and may be interrupted for short intervals and continued when the accumulation of repair jobs and emergency work makes it necessary. However, if the repair and emergency work is considerable, contract electricians are used.
5. Our system of maintenance is now flexible and similar to a chain in that chain links can be added or the chain can be broken and reconnected without greatly reducing the value or the strength of the chain.

The job-order system is essential to work scheduling. With this system, repair work is requested on a job-order form on which is provided space for location of equipment to be repaired, brief description of trouble, priority of work, and pertinent information such as parts needed and cause of trouble when this information is available. The work is then scheduled according to its importance.

Much of the oil-field electrical maintenance is of a repetitive or similar nature which permits the maximum use of standard maintenance procedures and instructions. Our use of standard practices has been particularly advantageous because it has improved the quality of maintenance work, reduced supervisory requirements, and simplified the training of men.

ACTUAL MAINTENANCE REQUIREMENTS FOR ELECTRIC BEAM-PUMPING EQUIPMENT IN AREA 1
(Based on actual work performed for 5-months' period.)

Job classification—	No. jobs	Man-hours	Mileage
Preventive-maintenance checks	378	567.0	5,292
Time-delay relay repairs	39	74.1	780
Checking and replacing overload heaters	12	28.8	378
Repair and replacement of overload relays	3	12.0	117
Replacement of meter protectors	3	9.0	138
Repair and replacement of time clocks	7	10.5	133
Replacement of surge capacitors	1	1.8	35
Replacement of circuit breakers	2	6.0	64
Repair and replacement of selector switch	2	4.0	32
Repair of magnetic starters	3	8.1	108
Starter connection work	2	4.4	52
Repairing and checking of grounds	6	7.8	108
Service repair and revision	2	12.0	148
Electrical measurements and testing*	14	21.0	406
Motor-winding failures	1	8.0	82
Motor-bearing replacements	13	75.4	468
Motor cleaning	6	12.0	148
Replacement of motor sheaves*	27	59.4	810
Replacement of service pole arresters	5	10.0	230
Refusing	34	88.4	1,054
Line repairs	8	43.2	336
Transformers bank repairs	3	24.0	255
Receiving calls and posting records	260	78.0	0
Checking tools and replacing equipment	26	26.0	130
Total	857	1,190.9	11,304

$$\text{Maintenance cost per motor per month} = \frac{\$6,517.84}{167 \times 12} = \$3.25$$

*Not ordinarily considered electrical maintenance.

Note: One electrician takes care of the electrical work in Area 1 and two adjacent areas which were not covered by this tabulation.

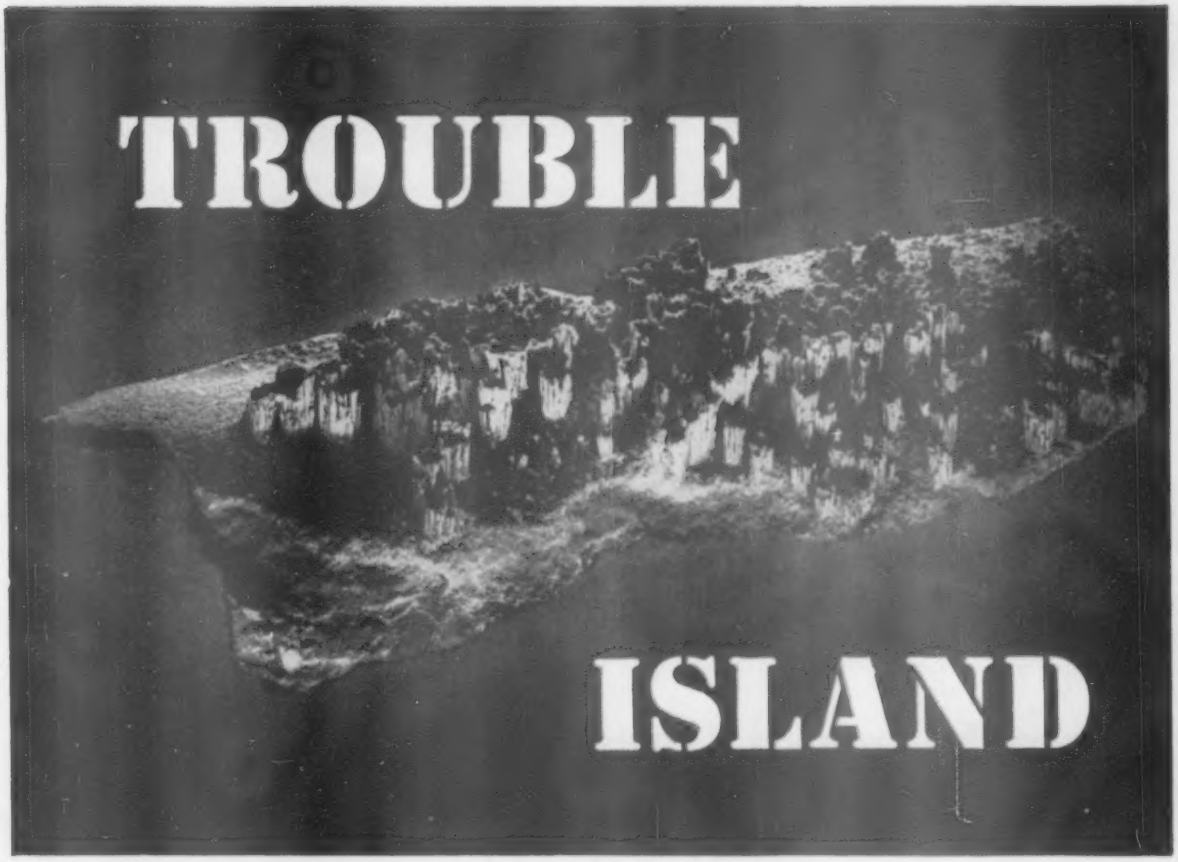


Photo is of a condenser-tube scale sample, about eight inches long. Solid scale is approximately ¼-inch thick, with "spires" ranging up to ⅜-inch height.

FIFTEEN years ago, this small island of trouble was part of a much larger open-box condenser problem at a refinery. Cooling water, running over 200°F. at outlet, contained 30 grains per gallon hardness and 20 parts per million iron. Tubes scaled heavily and rapidly without chemical inhibitor. Even with the best inhibitor then known, results were as illustrated above: partial inhibiting action creating the "spires" or forest-like deposits on tubes.

Considering this a challenge, Nalco sent a Doctor of Physical Chemistry — an expert water technologist — to the refinery. His weeks of work on the spot led to basically different treatment with new chemicals which cleaned up the condenser and kept it clean. Further Nalco research and development of chemical inhibitors has since enabled cooling systems to operate without scale or corrosion *with water hardnesses as high as 200 grains per gallon.*

Point is this: neither Nalco nor anyone else had an answer to scaling in that condenser. Nalco put the necessary brains to practical use and *got results* . . . benefiting, in the long run, not only that particular refinery, but every user of cooling water.

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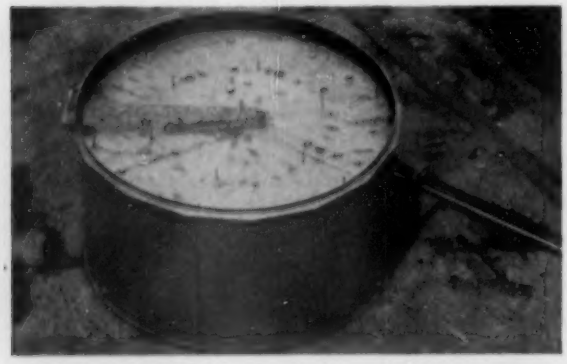
THE *Nalco*® SYSTEM . . . Serving Industry through Practical Applied Science

Esso Standard Opens Big New Terminal for Refined Products at Waltham, Mass.

Important news to New England oil marketers was the opening of operations last July of the region's first catalytic cracking unit at Esso Standard Oil Company's Everett, Mass., refinery. The ultra-modern "cat" boosted the refinery's output to almost 45,000 barrels per day.

Tied in with the expanded refinery operations is a big pipe line terminal, recently completed in nearby Waltham. There the highly seasonal products of the Everett refinery — domestic fuel oil, kerosene, gasoline and diesel fuel — are stored during periods of slack demand.



Bethlehem Double-Deck Floating-Roof Tanks are especially suitable for the storage of volatile refined products. Pontoon construction provides "dead" air space, protects the product quality and prevents evaporation losses.

Completed early in 1954, the terminal consists of twenty tanks, all designed, fabricated and erected by Bethlehem. Sixteen of these, totaling 1,060,250 barrels, are of the cone-roof type. The remaining four tanks, of Bethlehem's double-deck, floating-roof design, provide what Esso Standard terms "the safest known method of commercially storing gasoline in large quantities."

A letter or phone call to the nearest Bethlehem sales office will promptly bring you full information about Bethlehem Oil Storage Tanks. Or, if you would like a copy of our booklet describing the construction features of floating-roof, lifter-roof, and cone-roof tanks of Bethlehem design, please send your request to:

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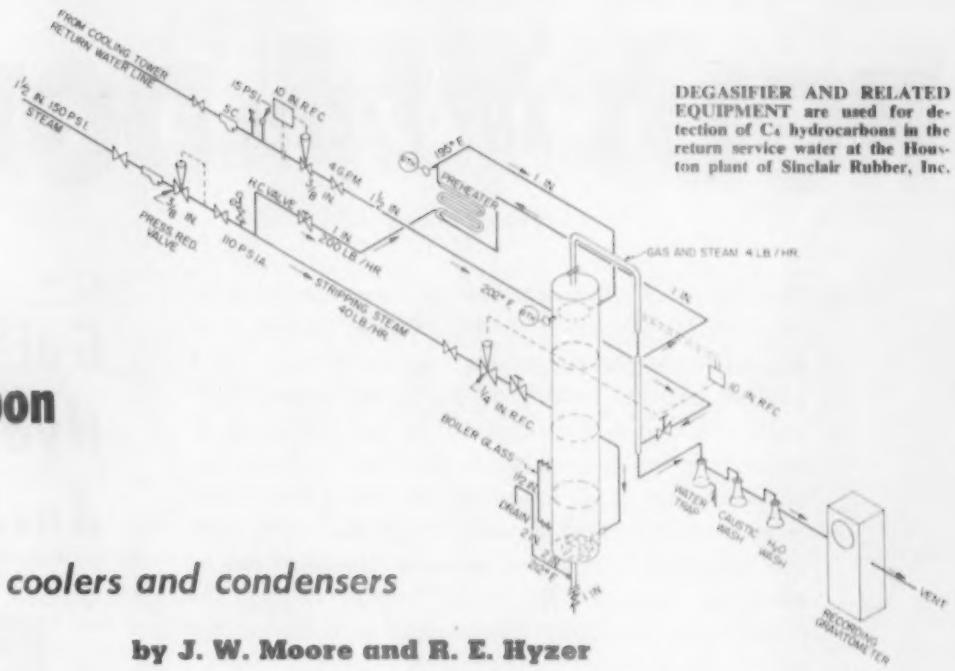
BETHLEHEM STEEL

POINTER PROCESS

How to Detect Hydrocarbon Leakage

...in coolers and condensers



DEGASIFIER AND RELATED EQUIPMENT are used for detection of C_4 hydrocarbons in the return service water at the Houston plant of Sinclair Rubber, Inc.

by J. W. Moore and R. E. Hyzer

EARLY detection of leaking tubes in hydrocarbon condensers and coolers is of importance in the economical operation of hydrocarbon processing plants. If the hydrocarbon is in the butane range, the leak may become quite large before it is discovered. This not only involves the monetary loss of the product but can materially increase other costs such as chlorine used in the cooling water for algae control.

The successful solution of this problem at Sinclair Rubber, Inc., involves a degasifier which continuously distills dissolved gases from a stream of return cooling water, removal of CO_2, and a gravitometer to differentiate between air and hydrocarbons in the distilled gases. The operating principle is based on the fact that the effluent water from a forced-draft cooling tower operating in a normal temperature range will contain approximately 10 p.p.m. of dissolved nitrogen and oxygen with a specific gravity of 1.0 referred to air, while the butane fraction has a specific gravity of about 2.

A mixture of these gases will give a gravity reading in the range of 1.00 and 2.00, depending on the amounts of each gas present. The removal of carbon dioxide, heavier than air, is necessary since the gravitometer is required to indicate small differences in the gravity of the distilled gases. A small amount of CO_2 would give a false indication or mask the presence of the hydrocarbons. Caustic scrubbing of the mixed gases assures its removal.

Authors are with Sinclair Rubber, Inc. at Houston. Paper presented at Symposium on Testing L.P.G. at St. Louis, September 27-28, 1954.

The unit consists of a preheater, stripping tower and condenser, CO_2-removal system, and gravitometer with a range of 0.7 to 1.7 gravity referred to air.

The preheater was built of two 10-ft. lengths of 1½-in. brass pipe internally heated throughout its length with a ⅜-in. copper tube. The tubing has ⅛-in. holes drilled on 4-ft. centers, ending 2 in. short of preheater outlet. Flow of water and steam is concurrent.

The tower is a 7-ft. section of stainless-steel 8-in. schedule 20 pipe fitted with three removable perforated trays and a gage glass. Water is admitted near the top through a distributor ring and drawn out the bottom. Steam is admitted near the bottom of the tower through a coiled ⅜-in. copper tube with five ⅛-in. holes, the end of the tube being crimped.

The overhead condenser is made of 1-in. brass pipe jacketed with a section of 2-in. brass pipe. Cooling water flow is countercurrent to the steam-and-gas overhead stream from the tower.

The accompanying piping and instrument drawing outlines the flow through the equipment. A small portion of the return service water, 4 g.p.m., is flow controlled through the condenser as a cooling medium, then to the preheater where it is heated to 190° to 195° F. Water, leaving the preheater, enters the degasifier near the top above the first of the three perforated trays. Steam, admitted to the bottom of the degasifier, vaporizes part of the downflowing water stripping out the dissolved gases, air, CO_2 and hydrocarbons if present. The hot water leaves the bottom of the tower through an inverted siphon which acts as a seal.

Open steam to the bottom of the tower is regulated by a recording flow controller, measuring the overhead stream. The overhead, about 4 lb. per hour, is predominately steam which is condensed in the condenser and the water is trapped out and removed through another inverted siphon. The noncondensable gases go to the scrubber for CO_2 removal. The tower operates at 8 to 10 in. of water pressure.

The mixed gases are scrubbed in three stages with 8 per cent caustic soda. A final water wash assures a gas of constant relative humidity to the gravitometer.

Caustic was changed in the CO_2 scrubber at 9:00 a.m. on February 13, and the gravitometer purged with air. The increase in gravity at 12:20 p.m. was not recognized as a possible hydrocarbon leak since adjustments to the equipment were being made. The unit was out of service from noon until about 3:00 p.m. when it was put back into operation. The gravity increase shortly after 3:00 p.m. was not reported. Caustic was changed at 9:00 a.m. on the morning of February 14, and the unit purged with air.

The immediate increase in gravity was noted and a search instituted in the processing area for a hydrocarbon leak. One of the butadiene tower overhead condensers was found leaking and steps were taken to recover the leaking hydrocarbon. The gravitometer records this at 1:00 p.m. as evidenced by a slight decrease in gravity. Gravitometer readings returned to normal when the leaking condenser was removed from service. Calculations based on the gravity of gas indicated a loss of approximately 2 bbl. per hour.

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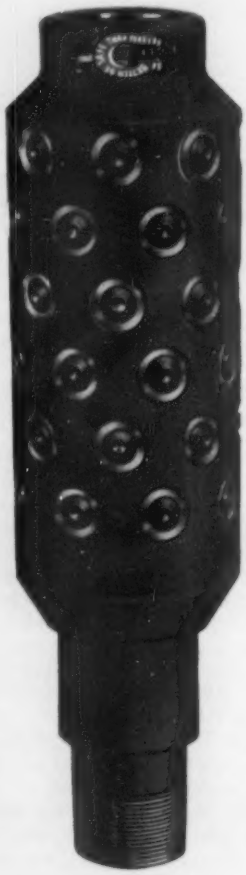
The Type "H1" Hydraulic Anchor is recommended for use with all Guiberson production-type packers — or any other comparable production-type packer — as a positive means of holding the packer and tubing down while the well is pressured below the packer, as in acidizing or formation-fracture processes. It is also recommended for use in anchoring the tubing and packer in gas or water injection wells where the tubing pressure will exceed the casing pressure. The "H1" can be effectively used as a Hydraulic Anchor to keep the tubing from "breathing" in pumping wells having low working fluid levels.

Simplicity of design and completely automatic operation make the "H1" exceedingly easy-running, easy-pulling — it may even be run upside down without the slightest effect on its operation. Case hardened piston slips in Monel inserts assure positive action and maximum corrosion resistance. Piston slips operate independently and provide equal distribution of gripping force against the casing I.D. with no localized high pressure areas. This, coupled with a limited piston slip stroke, positively precludes swaging or damaging casing in any way. Piston slip gripping area is 100% effective in any weight casing within the anchor size range. "H1" anchors are individually tested and will hold any pressure the tubing will stand.



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Designing and Applying High-Speed Turbines—2

by H. Steen-Johnsen

HAVING taken a brief look at standard turbines in the first installment of this series, let's turn to high-speed turbines. We'll start off considering what will happen to a standard machine if we just increase the speed.

The first thing that happens is that centrifugal stresses at the hub of the disks increase so that the disks tend to become loose on the shaft. Next the bucket fastenings show up as inadequate for the increased stress that develops with increased speed. And third, the stresses in the blade itself start to become excessive and the vane section tends to pull apart.

These three points relate directly to the rotor. In addition, there are other questions brought up about high-speed turbines. How about bearings, and lubrication, and oil supply? How about governing at high speed? How about the seals, alignment, and coupling? And is the thing heavy enough when running that fast?

General high-speed design . . . An evaluation of these problems and questions is best started by getting some of the answers from a turbine designed for high speed, Fig. 1.

Author is chief engineer, turbine division, Elliott Co., Jeannette, Pa. Paper presented at the petroleum-mechanical engineering conference of the A.S.M.E., held in September 1954 at Los Angeles.

The turbine elements needed here as before—rotor, bearings, seals, governor and so on. But the proportions have changed. And while the rotor is high speed, the governor and oil pump run at the same speed by just making a change in the gear reduction.

Turning to the rotor, the problem of the disk becoming loose on the shaft to some extent can be taken care of by increasing the shrink fit and by decreasing the diameter of the disk. But this is not too satisfactory because the diameter quickly becomes so small that there is not sufficient annulus area to pass the steam flow. Therefore, the most satisfactory answer is to forge the disks integral with the shaft to have what is commonly referred to as solid-rotor construction.

Such a solid rotor must be quite a special forging with both high strength and stability at elevated temperature.

The increased load on the bucket shanks is taken care of by using multiple hooks on the shank such as a pine-tree arrangement. An external pine tree such as is pictured first of all gives more lateral stability and secondly gives better use of a given volume of material used in the bucket shank. The crushing load is distributed on a larger area by the multiple hooks on the pine tree. Spreading of the pine tree is prevented by a lip on the disk coming up outside the bucket.

We mentioned stresses in the vane section. These stresses, when excessive, are reduced by tapering the bucket from the base to the tip. By this arrangement, the stress along the bucket can be kept more or less constant at a nominal value which is about the same as the stress level selected for the bucket shank.

These are the essential changes that are made in rotor construction for high speed, and within certain limits a machine like this may still be a single-valve turbine.

But as the horsepower and flow increase or the throttle pressure goes up, the single control valve becomes hard to handle and it is desirable to use a multivalve-inlet arrangement, Fig. 2. This gives better performance as well as more uniform speed control over the load range of the unit. This is especially true for throttle pressures of 600 psig. and higher, such as 850 psig. —900° F., now frequently coming into the picture on turbines in this horsepower range.

In a turbine, the maximum horsepower of a unit is limited by the flow that can pass through the last stage. And a condensing unit such as this one, Fig. 2. depending upon the vacuum, can handle up to 5,000 hp. at 12,000 r.p.m. For lower vacuum requiring shorter blades in the last stage, the speed could be higher.

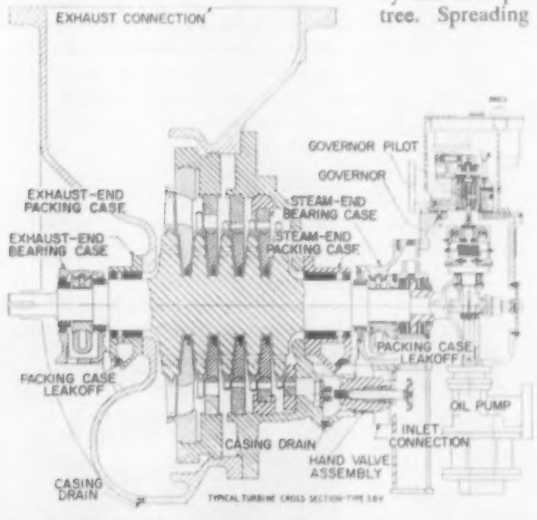

Fig. 1—High-speed, multistage turbine with vertical oil-relay governor and single governing valve.

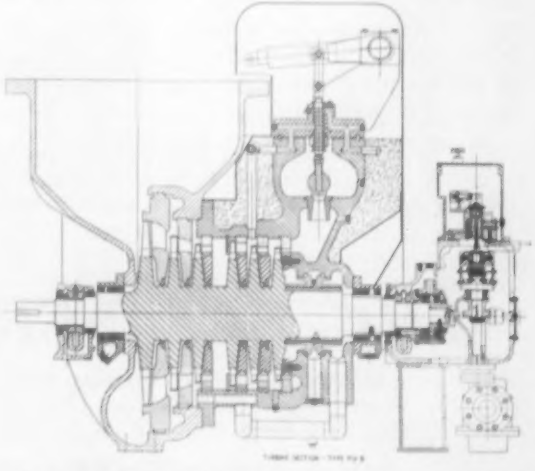

Fig. 2—High-speed, multistage turbine with vertical oil-relay governor and multiple governing valves.

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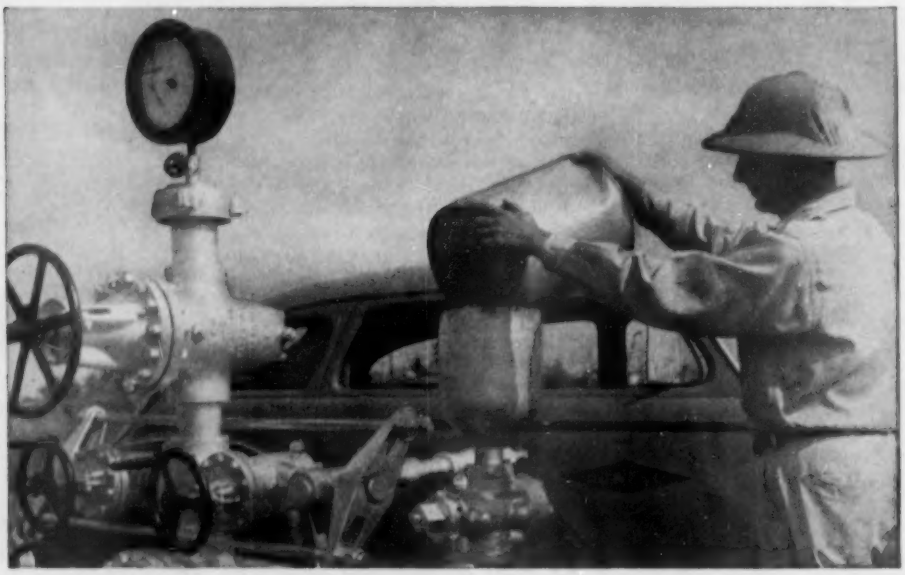

There was a time when an accumulation of paraffin in a well or lead line presented an almost insurmountable obstacle to an operator. Its removal was expensive in time, money and manpower.

This, of course, was before Dowell entered the picture. Today, Dowell Paraffin Solvents dissolve these paraffin accumulations quickly and help restore operating efficiency at minimum expense.

In one case, for instance, a well that was producing 60 BOPD averaged 130 BOPD on a 30-day test after Dowell Paraffin Solvents were applied. That's an increase of over 100% in daily production efficiency—all for a few dollars worth of solvents.

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Controlling Slime and Algae Growths—2

How Chlorine Is Used to Control Slime and Algae

by P. B. Conlan

A NUMBER of chemicals have been employed for the control of slime and algae growths in cooling-water systems. These materials possess high toxicity toward microorganisms, and generally effective control of slime and algae is obtained by the feed of a relatively small quantity of the control agent.

Before making a selection, complete data on the system should be reviewed. Recommended methods for feeding suitable agents should be considered because some of these materials require more expensive feeding apparatus. In some cases it may be necessary to consider the alternate feed of various toxic agents at intervals for most effective and economical results.

Chlorine and chlorine products . . . Because of its high toxicity and quick action, chlorine in its various forms is widely used in the sterilization of water supplies. It is fairly general in toxicity for most bacteria, algae, and protozoa. A chlorine residual of approximately 0.5 p.p.m. will usually destroy most microorganisms. However, since chlorine acts on all oxidizable material, the chlorine demand of a water is greatly affected by the presence of organic matter, hydrogen sulfide, ferrous iron, etc. Thus sufficient chlorine must be added to the water to develop the necessary residual for toxicity and to satisfy the demand of other materials present in the water which are readily oxidized or possess the ability to absorb chlorine.

Chlorine is stable in neutral, acid, and alkaline waters, although its germicidal efficiency is reduced somewhat under alkaline conditions. When large amounts of chlorine are required, it is generally obtained in liquid form for economy and convenience. Then it is fed to the system by means of a chlorinator. Because of its corrosivity, the use of chlorine involves some hazards in handling. However, satisfactory chlorination equipment is available for this purpose.

Author is with W. H. & L. D. Betz Co., Philadelphia.

Where relatively small quantities of chlorine are required, calcium hypochlorite, sodium hypochlorite, and bleaching powder may be used. These materials may be dissolved in water and fed to the system through corrosion-resistant feeding equipment.

Because of the relatively high chlorine demand caused by the presence of oxidizable materials in the water, continuous chlorination for the control of slime in large once-through cooling systems may not be economically justified in each case. In the control of slime deposits in turbine condensers on a once-through basis, intermittent chlorination may be employed in order to minimize the high cost that would result from continuous chlorination. A relatively heavy dosage of chlorine is applied over short periods, and slime growths are controlled in this manner.

Chlorine is used for the control of slime and algae in open recirculating systems. However, because of its volatility, chlorine is aerated from the water in passing over the cooling-water tower or spray pond. The presence of any organic surface-active material used in the cooling-water treatment will also create a chlorine demand as will the presence of any reducing agents due to process leaks. If contaminants such as hydrocarbons, mercaptans, and sulfides are present in excessive quantities, it may be impossible to feed sufficient chlorine for control of slime.

In open recirculating systems, chlorine may be fed continuously or may be fed intermittently, at regular determined intervals, at the minimum residual required for the control of slime and algae growths. High concentrations of chlorine should be avoided because of the effect on cooling-tower lumber. Rapid removal of lignin occurs when wood is alternately subjected to highly alkaline solutions and oxidizing agents. However, in cooling-tower systems, the circulating water normally would not be highly alkaline. And, if chlorine were also employed, this material would not be present in sufficient quantity to promote rapid removal of lignin. Nevertheless, over-extended periods of time, deterioration of lumber will occur where circulating-water pH is high. This condition of deterioration is increased rapidly by increasing the chlorine residual.

In addition to chlorine and the chlorine compounds mentioned, the powerful oxidizing gas, chlorine dioxide, has been developed for disinfection of water supplies. Chlorine dioxide reacts with organic compounds and oxidizes these substances more rapidly than does chlorine alone. Chlorine dioxide residuals appear to be more effective in waters of high pH value than do residuals resulting from the use of chlorine.

However, because of its instability, chlorine dioxide must be generated at the point of use and applied immediately. For this reason, and also because of its volatility, it has not been used successfully in the control of slime and algae in recirculating cooling-water systems.

While chlorination usually will prove to be an over-all satisfactory material for control of slime and algae growths, it is possible that bacteriological growths may build up gradually even with the maintenance of a definite chlorine residual. Under such conditions, it is necessary to temporarily increase the chlorine residual or an algicide of another type can be applied intermittently to assure continued adequate control of these growths.

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How to Design In-Tank Jet Mixing Systems—14

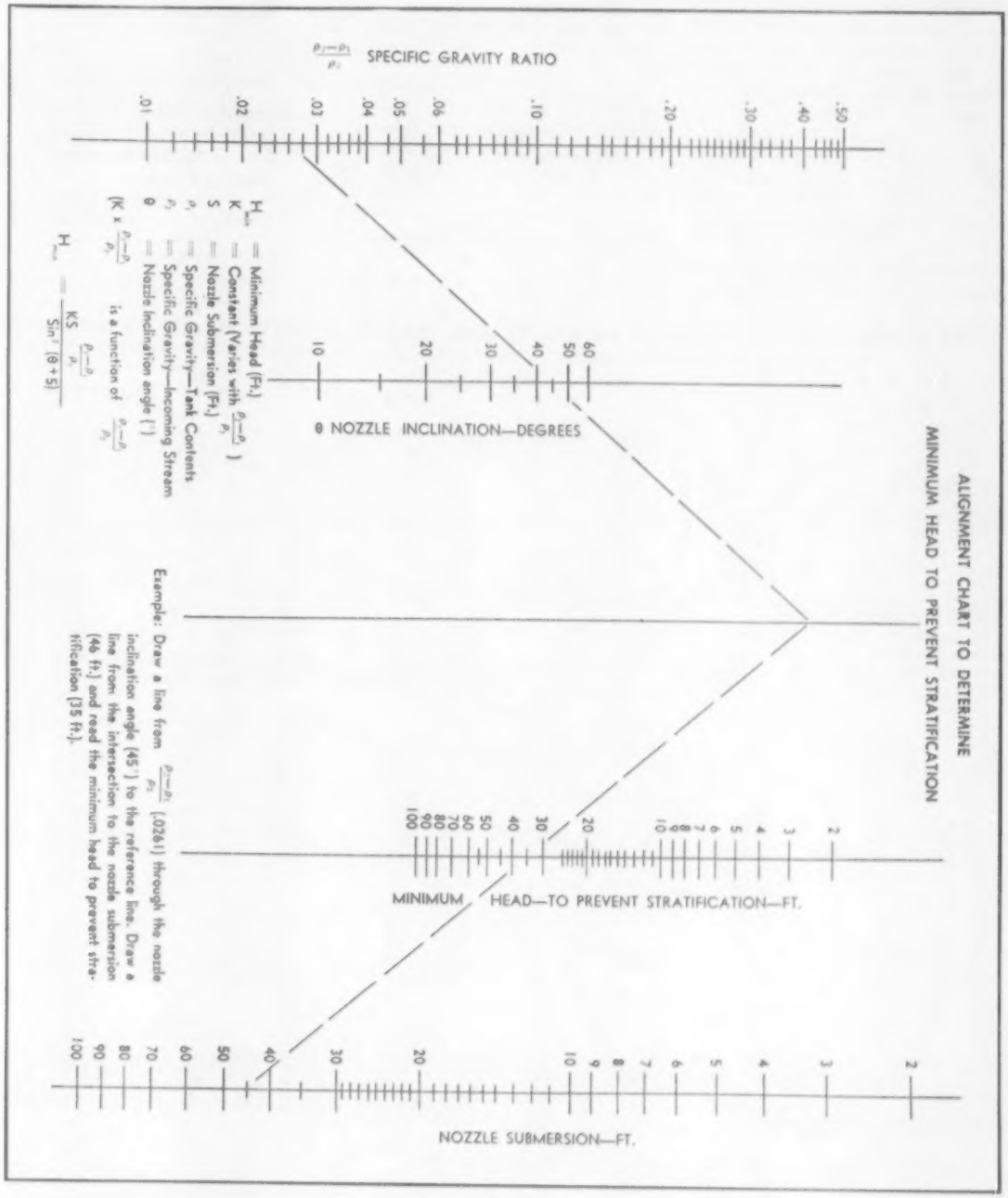

Fig. 10

This material from E. I. du Pont de Nemours & Co., Inc.

by W. L. Nelson
Technical Editor

QUESTIONS ON TECHNOLOGY

World Needs for Various Crudes

"What types of products are consumed in various regions of the world, such as the areas served by Middle East crude oil? Are the Middle East crude oils of the proper composition for meeting the demands?"—R. Wm. S.

In general the Middle East crude oils contain too much gasoline, or with cracking produce too much gasoline for the market demand that they serve. Middle East oil of 36° A.P.I. contains about the following amounts of straightrun products:

	Per cent
Gasoline	30.4
Kerosine distillate	14.0
Gas oil, heavy (550°-700° F.)	16.2
Reduced crude oil	38.1

Such an analysis does not match the demands of Asia, Africa, Europe, or most other regions (see Table 1). Although the amount of kerosine distillate is adequate, it contains so much sulfur that chemical treatment is necessary in meeting the specifications in some areas of consumption.

There are really only three (or two) major sources of extra crude oil throughout the world, and these serve the following natural sales regions:

Middle East Sphere:
- Mediterranean
- East and South Africa
- Near and Far East
- Northern Europe (in part)

Venezuelan Sphere:
- South America
- United States East Coast
- Eastern Canada
- West and South Africa
- Northern Europe (in part)

Pacific Sphere:
- Alaska

TABLE 1—APPROXIMATE KINDS OF PRODUCTS REQUIRED IN REGIONS THAT CAN BE SERVED PRIMARILY BY MIDDLE EAST CRUDE OILS, LIQUID VOLUME PER CENT

WESTERN EUROPE

	Western Europe	Europe		Austria	Denmark	Finland	France	Germany	United Kingdom	Greece	Italy	Netherlands	Norway	Spain	Sweden	Switzerland
	1951	1950-51	1947	1950	1952	1951	1952	1951	1951	1952	1952	1952	1952	1951	1952	1951
Gasoline	26.5	33.5	28.3	24.4	32.1	47.2	33.2	35.4	38.5	22.2	19.3	26.7	16.9	38.3	20.0	32.4
Kerosine	5.6	6.4	12.9	4.6	3.8	10.2	1.2	1.3	9.3	8.4	4.0	8.3	2.8	2.1	4.5	4.6
Distillate and diesel fuel	22.3	21.6	*8.3	59.0	59.7	21.8	9.9	32.2	24.9	21.8	19.3	23.0	34.8	18.1	35.5	58.0
Residual fuel	35.5	26.6	*31.2			13.4	44.2	16.2	16.0	40.5	48.4	31.2	39.0	31.5	34.8	
Lubes		3.6	3.7		1.9	3.4	3.1	6.9	4.4	1.1		2.8	1.5	4.0	1.5	
Others	10.1	8.3	15.6	*12.0	2.5	*4.0	8.4	8.0	6.9	*6.0	*9.0	*8.0	*5.0	*6.0	3.7	*5.0
A.P.I. of crude oil required	20.0	25.5	19.5	18.0	18.0	46.0	17.0	36.0	37.0	19.0	16.5	23.5	19.5	22.6	22.0	27.0
Consumption, Million bbl.	474	386		4.6	13	4.7	83.3	35.4	130.8	9.2	41.5	21.4	14.2	10.5	36.0	9.0
Reference	(1)	(2)	(3)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)

ASIA

	Asia	India, Pakistan, Burma & Ceylon	Rest of Asia†	Australia	Oceania	Ceylon	Indonesia	Japan	India	Malaya	New Zealand	Pakistan	Philip. Islands	Siam
	1947	1951	1951	1951-52	1947	1951	1950	1952	1951	1950	1951	1952	1950	1950
Gasoline	16.7	27.1	31.1	44.2	46.0	14.9	25.4	27.4	26.1	26.6	51.7	16.5	41.5	35.4
Kerosine	16.9	26.5	11.3	7.7	9.4	7.4	20.1	2.0	28.0	8.5	2.4	15.9	12.3	20.8
Distillate and diesel fuel	*19.4	18.2	26.0	18.7	*12.2	18.1	46.5	7.4	18.5	56.9	13.9	13.7	38.2	35.8
Residual fuel	42.6	22.7	28.0	19.4	*25.9	57.3		55.6	21.2		22.7	49.4		
Lubes	*2.9	*3.5	*2.5	3.0	4.7	0.8		5.2	4.2		2.3	*2.0		
Others	*1.5	*2.0	*1.1	*7.0	*1.0	*1.5	*8.0	2.4	*2.0	*8.0	*7.0	*2.5	*8.0	*8.0
A.P.I. of crude oil required	18.5	31.0	27.0	34.0	28.0	16.0	27.0	15.0	33.5	17.0	30.5	17.0	24.0	32.0
Consumption, million bbl.		41.0	54.7	44.4		6.6	12.8	32.8	30.8	6.0	9.9	9.2	9.7	2.0
Reference	(3)	(5)	(5)	(5)	(3)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)

AFRICA

	Africa	Tunisia	Algeria	Kenya and Uganda	Morocco	Rhodesia and Nyasaland
	1947	1951	1950	1950	1951	1951
Gasoline	28.1	30.2	34.8	30.2	39.9	63.2
Kerosine	11.1	10.6	10.8	8.2	5.2	13.8
Distillate and diesel fuel	*8.0	26.6	46.4	53.6	46.9	15.0
Residual fuel	*41.8	25.5				
Lubes	2.7	2.6				
Others	*8.3	4.5	*8.0	*8.0	*8.0	*8.0
A.P.I. of crude oil required	18.0	28.5	25.0	24.5	23.0	49.0
Consumption, million bbl.		2.2	4.1	2.7	4.5	1.8
Reference	(3)	(6)	(6)	(6)	(6)	(6)

*Estimated. †See column just ahead.

TABLE 2—APPROXIMATE KINDS OF PRODUCTS REQUIRED IN REGIONS THAT CAN BE SERVED PRIMARILY BY VENEZUELAN CRUDE OIL, LIQUID VOLUME PER CENT

	South America 1947	U. S. East Coast states 1959	Union South Africa 1951	Gold Coast (Africa) 1950	Nigeria (Africa) 1950	Congo 1950	French West Africa 1950	Venezuela 1951	Canada 1947	Caribbean disposal§ 1949	World excl. U. S. 1949
Gasoline	23.6	35.8	49.7	40.6	56.5	67.2	53.4	24.0	46.9	25.6	26.4
Kerosine	6.4	7.4	14.2	13.9	20.8	7.3	12.8	7.7	8.3	6.7	24.0
Distillate and diesel fuel	*15.9	19.5	13.7	37.5	14.7	17.5	25.8	11.1	*14.5	18.4	
Residual fuel	*47.7	27.8	13.9					36.8	*21.9	49.3	41.3
Lubes	1.5	1.7	2.5						2.3		2.1
Others	*4.9	7.8	*6.0	*8.0	*8.0	*8.0	*8.0	‡20.3	*6.1		6.2
A.P.I. of crude oil required	17.0	25.5	44.0	25.0	53.5	50.0	32.0	18.0	31.0	17.5	18.5
Consumption, million bbl.		754.0	23.1	1.5	1.7	1.3	1.4	25.1			1,503.0
Reference	(3)	(7)	(6)	(6)	(6)	(6)	(6)	(8)	(3)	(9)	(10)

*Estimated. †See also Europe, France, Denmark, Norway, Sweden, etc., of Table 1. ‡Includes crude oil (16.8) used as such. §Excluding shipments to United States.

Western North America
Japan (in part)

Overlapping occurs and the spheres of sale are altered somewhat by posted prices and by changes in tanker rates. The kinds of products required in various regions is indicated in Tables 1, 2, and 3, but only the following most approximate averages can be stated because the source of oil for each region is constantly changing:

	Middle East Sphere	Venezuelan Sphere	United States and Canada	World excl. U. S., Canada & U.S.S.R.
Gasoline	30.0	28.3	45.0	29.0
Kerosine	9.0	6.3	5.5	7.8
Distillate	18.2	13.9	15.5	16.0
Residual fuel	31.0	46.5	24.0	39.0
Lube oils	3.0	1.0	2.1	2.0
Others	8.8	4.0	7.9	6.2
Approximate A.P.I. of crude oil required	22	17	30	20

It will be noted in Tables 1, 2, and 3 that information about demands is sometimes contradictory.

Crude oils to supply the demands shown in the tables must also supply the 8-12 per cent of residual fuel oil used by the refineries. Accordingly, the crude-oil gravities are a little lower than would seem to be needed by the composition of the products. In the United States and a few regions, gasoline is much in demand and, accordingly, high-gravity crude oils are much prized. However, somewhat low gravity (about 20° A.P.I.) crude oils are needed throughout most of the world.

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TABLE 3—APPROXIMATE KINDS OF PRODUCTS REQUIRED IN REGIONS SERVED PRIMARILY BY THE UNITED STATES

	United States 1951	United States 1949-50	Canada 1947	Philippine Islands 1950
Gasoline	42.5	45.0	46.9	41.5
Kerosine	22.3	5.0	8.3	12.3
Distillate and diesel fuel		16.3	*14.5	38.2
Residual fuel	22.0	24.5	*21.9	
Lube oils	1.7	1.6	2.3	
Others	11.5	7.6	*6.1	*8.0
A.P.I. of crude oil required	†30.0	†30.0	†32.0	24.0
Consumption, million bbl.	2,560.0			9.7
Reference	(10)	(11)	(3)	(5)

*Estimated. †Served primarily by natural-gas fuel. If residual fuel were burned in the refinery, the gravities would be about 1.5 units lower.

Penetration of Asphalts Produced By Vacuum Distillation

"What is the relationship between the melting point and the penetration of asphalts?"—S. P. W.

The properties of asphalts seem to vary with the crude-oil source being somewhat as shown in Fig. 1. Very many of the points shown on the Mexican curve are for Panuco asphalt, many of the points on the Venezuelan curve are for Mene Grande asphalt, and many of the Californian points are for Coalinga asphalt. Natural asphalts are usually very hard:

	Softening point, °F.	Penetration
Trinidad	206-210	1.5- 4
Bermudez	139-152	20.0-25
Albanian	222-250	2.0- 4

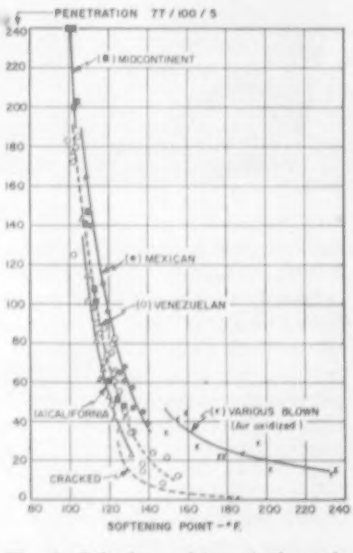
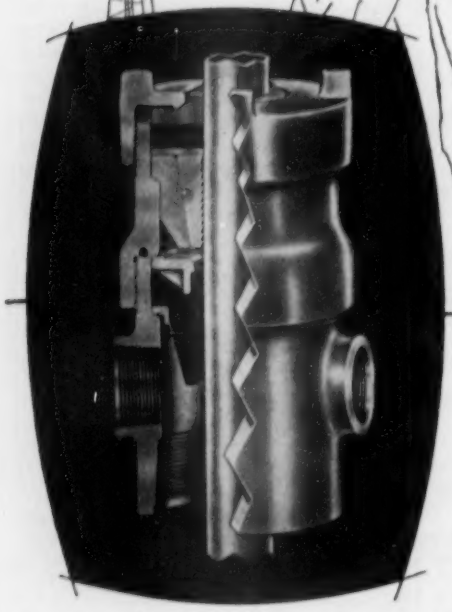


Fig. 1—Softening point-penetration relationships of vacuum-refined asphalts.



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by
R. I. Martin

ELECTRIC LOGGING—49

How the Radioactivity-Logging Tool Works

THE condenser used in radioactivity-logging instruments causes a lag in the recording equipment. If the counter is moved from a position of high radioactivity to one of low radioactivity, the recording apparatus will not react immediately. The charge on the condenser will decrease with time and may be expressed by:

$$Q = 100\,(1 - e^{-t/RC})$$

where Q is the charge on the condenser, e is the logarithm base, t is the time in seconds, R is the resistance, C is the capacity of the condenser, and 100 is introduced to give the results on a percentage basis.

In the discussion which follows, 100 per cent deflection is arbitrarily assumed for sand and zero per cent for shale.

The particular time, t, that is equal to the product of R and C is defined as the time constant of the circuit. In this time, 63 per cent of any change which takes place is measured by the recorder. This effect is shown in Fig. 1.

A theoretical gamma-ray peak is shown as a rectangular diagram bounded by broken lines. It is assumed first that the counter is of extremely short length, has a time constant of 7 seconds, and that the logging speed is 720 ft. per hour, or 4 ft. in 20 seconds. The resulting curve is shown by the solid line with hollow circles. A change takes place when the counter crosses the right-hand boundary and attains a value of 63 per cent after 7 seconds. After this, the rate of increase becomes much less rapid and the full value is not reached until 30 to 40 seconds.

After the left-hand boundary has been passed, the apparatus responds rapidly at first and the value decreases by 63 per cent in 7 seconds. Thereafter, the decrease is less rapid.

As a result, the peak on the log appears distorted toward the left. If the midpoint of each slope is considered, the offset is about 1 ft.

Author is assistant professor of petroleum engineering, Missouri School of Mines and Metallurgy.

The theoretical curve shown is smooth and shows no statistical variations. In practice, an extremely large time constant will have to be used to do this and the logging speed would have to be reduced accordingly. Consequently a time constant is used so that the variations are 5 per cent, or less, of the full scale reading. If the peaks are large, the value of 5 per cent will apply. For smaller peaks, however, the statistical variations will be larger in proportion.

In practice, the counter is of appreciable length, so that it will be convenient to consider the case of a counter 4 ft. long. In this discussion, it is assumed that the counter can be operated with a zero time constant. In this case, the recorder intensity will be an average of that opposite the length of the counter. The point at which measurements are recorded is the midpoint of the counter.

When the top of the counter is opposite the right-hand boundary, it will begin to react. When the point of measurement is opposite the contact, it will read one-half of the total deflection. It will record the full deflection when all the counter is opposite the sand. A corresponding sequence of changes will occur at the other boundary. The result is the trapezoidal diagram whose sides are shown as solid lines in Fig. 1. Again, the curve is not a practical one because the time constant can never be zero.

When these two effects, time constant of 7 seconds and counterlength of 4 ft., are considered the resulting curve is shown by the broken line with hollow circles. This curve does not depart materially from that obtained with a counter of very short length. It starts 2 ft. below the boundary, but when the midpoint is reached, the two curves are close together and remain close together. Similar remarks apply to the other boundary.

Actually, only about 5 per cent of the anomaly takes place in the first foot. As statistical variations are of this magnitude, the features in the first foot are not significant. Another factor to be considered here is the travel of gamma rays from the shale to the sand across the contact. The effect of this is to extend the anomaly at the base of the peak, but the over-all effect is small. By the time the midpoint of the deflection has been reached, the distance of the curve from the actual boundary is 1.25 ft. under the conditions stated.

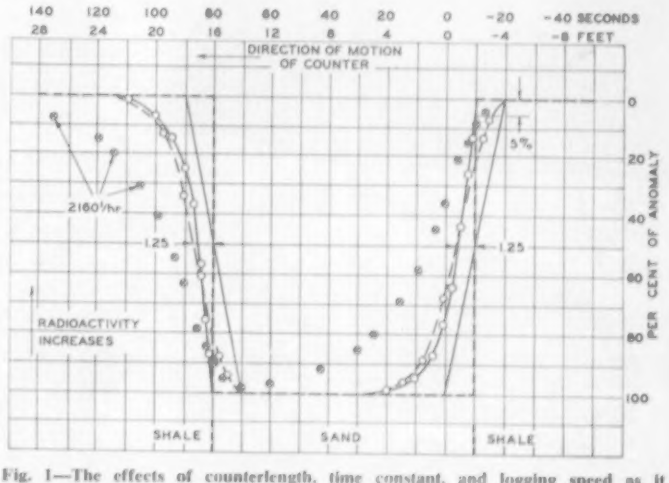

Fig. 1—The effects of counterlength, time constant, and logging speed as it relates to gamma-ray logging. From Kokesh, "Gamma-Ray Logging," The Oil and Gas Journal, July 26, 1951.

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Among the

Drilling Contractors

Wyoming Contractor Uses New Trailer-Mounted Rig

Hose-Austin Drilling Corp., Casper, Wyo., recently placed in operation a new, highly mobile trailer-mounted rotary rig designed for conventional rotary drilling in the depth range of 3,000 ft. to 7,000 ft., well-workover jobs to depths of 12,000 ft., and slim-hole drilling to 10,000 ft.

The rig incorporates the double-trailer Lee C. Moore heavy-duty 97-ft. mast set-up with one trailer carrying mast, the 8-ft. sub-structure, walkway, and rotary table. It will load out in 8 trucks, including 2 loads of drill-pipe, and requires only approximately 45 hours of set-up time on location. Racking capacity is provided for 7,200 ft. of 4¼-in. pipe.

Power for hoisting and rotating is supplied by twin Caterpillar D337 engines, rated at 450 hp. intermittent, compounded with Alamo Drive transfer power through an Emsco GB-250-T torque converter. Two additional D337 engines, rated at 320 hp., continuous, power the independently driven 7¼-in. by 14-in. mud pump.

Auxiliaries include a standby mud pump, powered from the driving-works compound; manual or hydraulic blowout equipment; hydraulically driven shale shaker, steel mud tanks, and vapor-proof lighting.

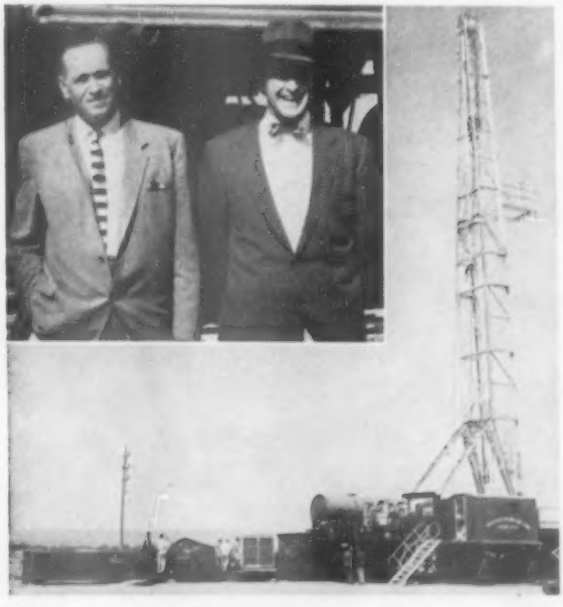
The contracting company is headed by Ray A. Hose, president; and Fleming C. Austin, vice president and general manager.

J. B. Fletcher, Shreveport, has a new operation under way for Marshall Steffenson, of Hagerstown, Ind., in the new Baker area, southeast of Lamar field, in Franklin Parish, northern Louisiana. It is at 1 Robinson, 1 mile southwest of the operator's recently completed gas-condensate discovery well in Tuscaloosa massive sand, perforated at 5,169-75 ft. The new test is projected to 5,300 ft.

Stearns Drilling Co. has a string of tools working for Aledo-Smitherman on a wildcat location northwest of Falls City field, in southeastern Cowley County, southern Kansas. Location is at 1 Walker, in 6-35-7e.

Power Rig Co. has a rig working for Sam J. Recile, of New Orleans, in East Hackberry field, Cameron Parish, Coastal Louisiana. Latest operation is 4 State Lease 42, in 36-12s-10w, a projected 5,000-ft. well.

Midwestern Drillers, Tulsa, reports three rigs busy, all in the Panhandle area of Oklahoma and Texas. One is drilling for Cities Service Oil Co. on a confirmation test to the newly discov-



New, highly mobile trailer-mounted rotary rig operated by Hose-Austin Drilling Corp., of Casper, Wyo. Shown in inset are Ray A. Hose (left), president; and Fleming C. Austin, vice president and general manager, of the contracting company, standing under elevated dog house at side of the rig on location.

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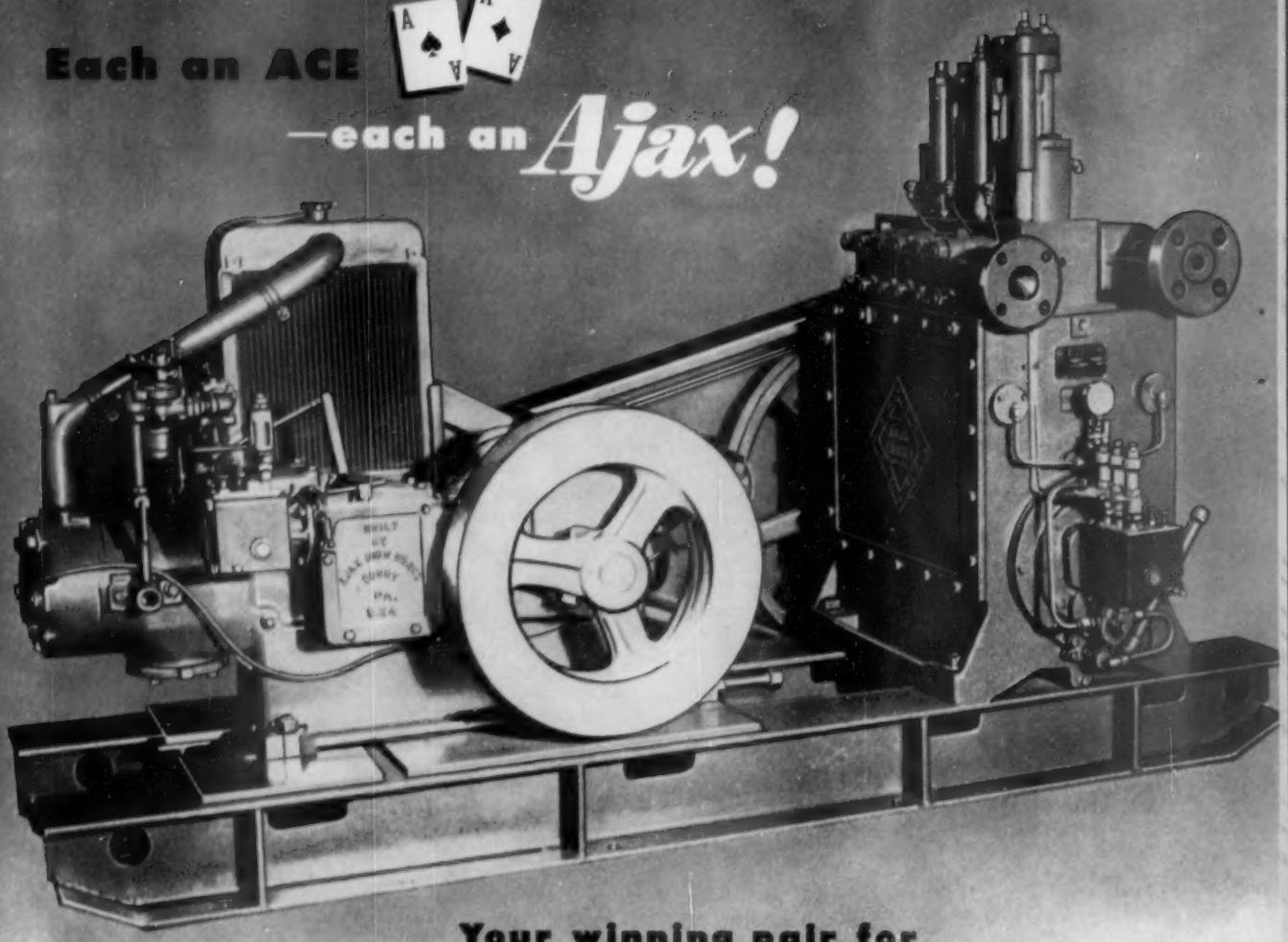

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ered 4,700-ft. oil sand in the Camrick gas area, southwestern Texas County, Oklahoma. Another is on a test The Texas Co. is drilling to confirm Phillips Petroleum Co.'s recent 6,200-ft. Permian oil discovery in the North Hutchinson area, Hutchinson County, Texas. The other is finishing up on a new gas discovery well drilled for O. H. Parker Producing Co. at 1 Hennigh, in 28-6n-28e, Beaver County, Oklahoma. The latter well was drilled to 6,300 ft., and is completing in sand at 6,140 ft.

Noble Drilling Co., Tulsa, is under contract for a deep wildcat test to be drilled in the far-northwestern corner of Lea County, New Mexico, for Amerada Petroleum Corp. It will be Amerada's 1 State SRA, with location in 14-9-32. Hole is projected to 11,500 ft.

Sabine Drilling Co. has a rig working for Magnolia Petroleum Co. in the new Warren-Abbo area, in eastern Lea County, New Mexico, near the Texas line. Current operation is at 1-F New Mexico, in 36-20-38. Depth objective is 7,500 ft.

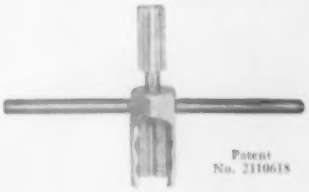
Big Six Drilling Co., Houston, is drilling on a new wildcat test for Fourth M. E. Andrews, Ltd., of Houston, 4½ miles south of Old Ocean field, in Matagorda County, Texas Gulf Coast. Location, at 1 Estill, is approximately 1,500 ft. northwest of a 7,500-ft. dry hole drilled by the contractor for the same operator.

Cactus Drilling Co., San Angelo, Tex., is listed as contractor on five new wells scheduled to be drilled in the Drickey Queen area of Chaves County, New Mexico. Four of the wells will be for Texas Pacific Coal & Oil Co. in 35-13-31, and one for Neville G. Penrose in 2-14-31. The contractor also is scheduled for a 3,000-ft. wildcat test at 1 Estate, in 20-15-31, also in Chaves County.

Miller & York, Bakersfield, Calif., have a new wildcat operation under way for Standard Oil Co. of California in the Slater area, northern Kern County, California. It is carried as 87 C.W.O.D., with location in 22-27-26.

Schimmel Drilling Co., San Antonio, is drilling on another wildcat test for Rodney De Lang and associates in the Crown area, western Atascosa County, Southwest Texas. Location is at 1 Smelley, in the Henry H. Wood Survey, about 5,500 ft. northwest of the above operators' newly completed Navarro oil-discovery well, productive from perforations at 4,294-4,313 ft. The new test is projected to 4,400 ft.

SUCKER RODS
Cleanout
TAP and DIES
by Baird



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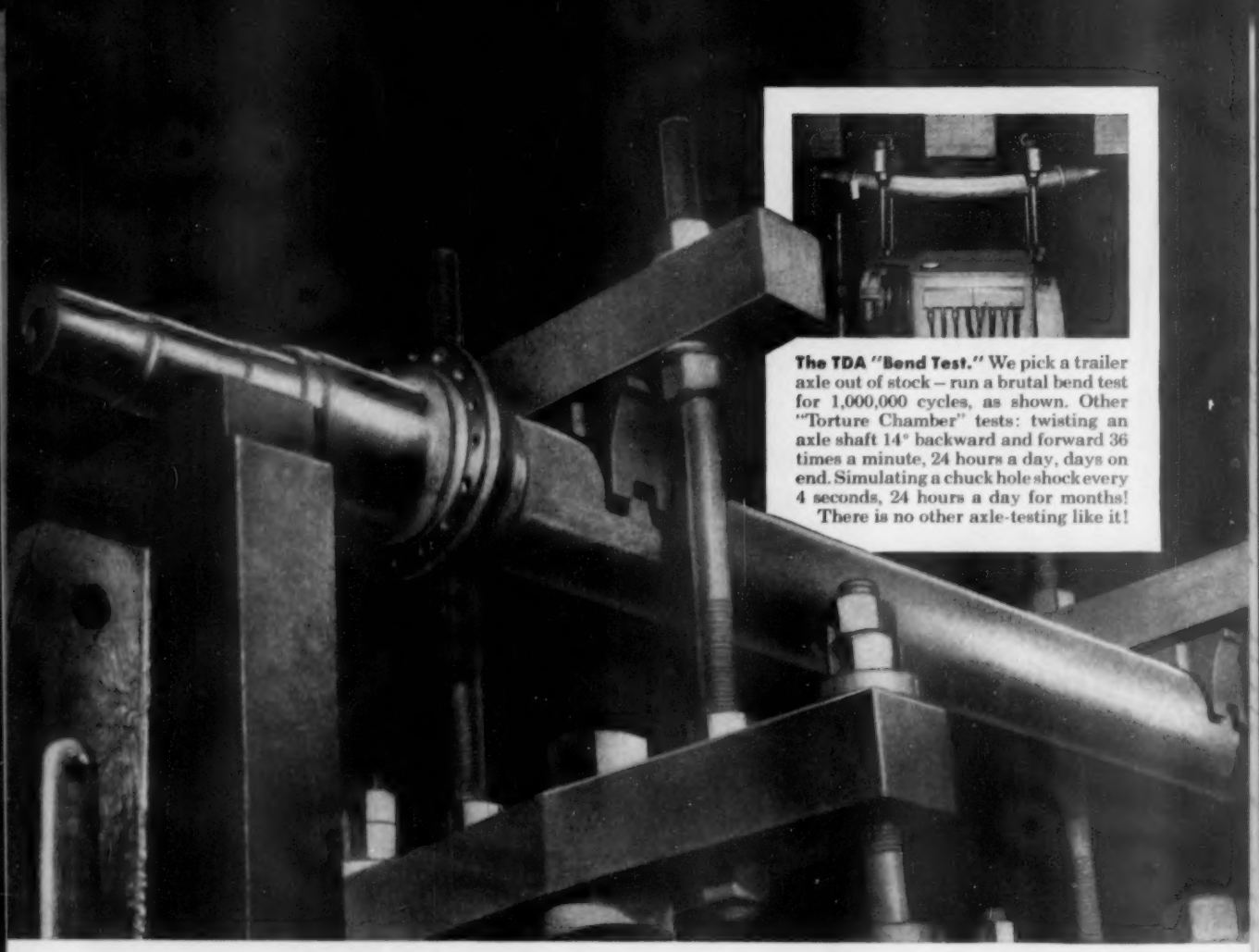

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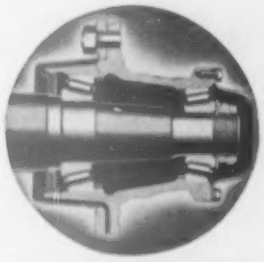

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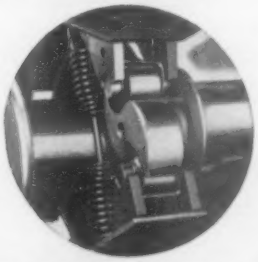

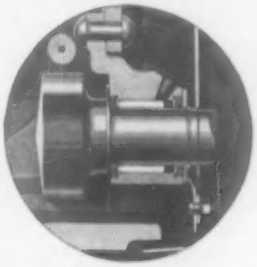

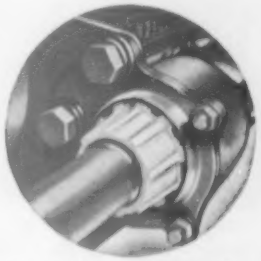

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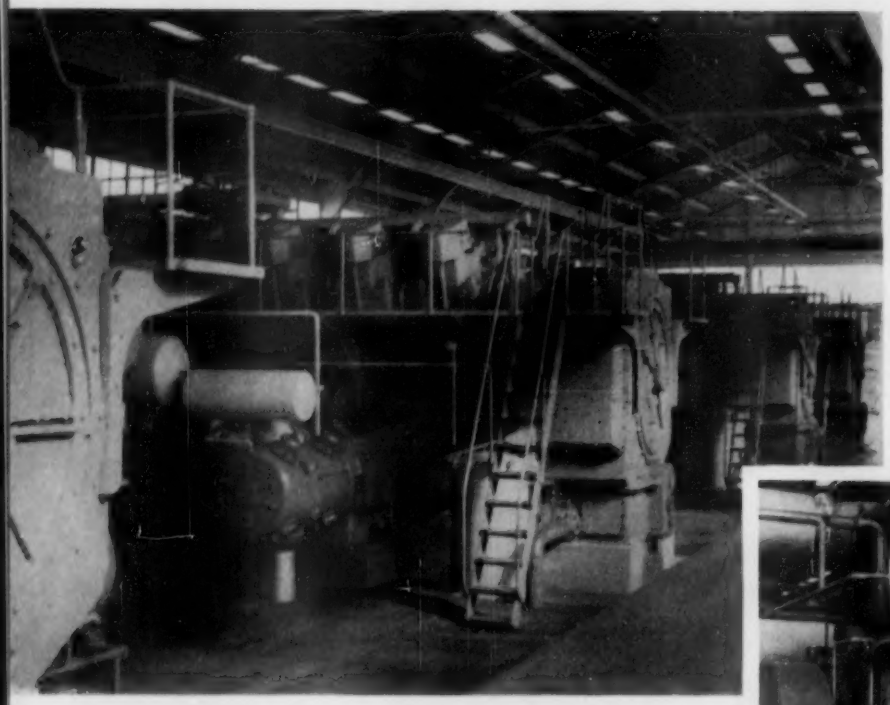
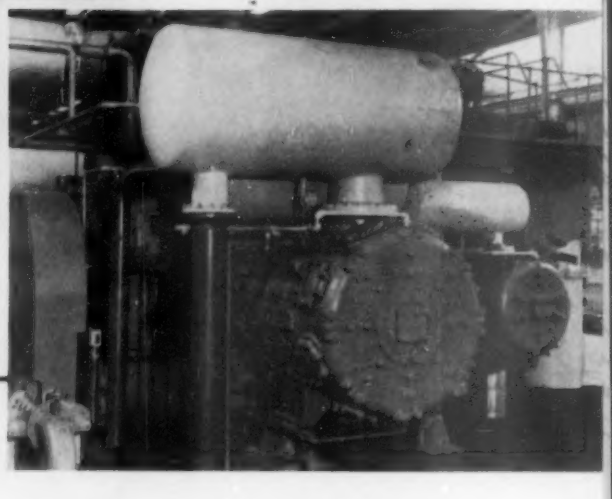
Another Example of Efficient Power at Lower Cost



This close-up view of a Cooper-Bessemer GMW clearly shows the neat, simple arrangement of compressor cylinders.



Shown here are the four Cooper-Bessemer compressors, rated 2000 hp at 250 rpm, in Spencer Chemical's modern Vicksburg, Mississippi ammonia plant. These 8-cylinder GMW's compress process streams such as natural gas, synthesis gas, and nitrogen.

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QUICK ACCESS to all moving parts is an important feature of the free-piston turbine.

Free-Piston Gas Turbine

2. How it compares with reciprocals

by Robert P. Ramsey

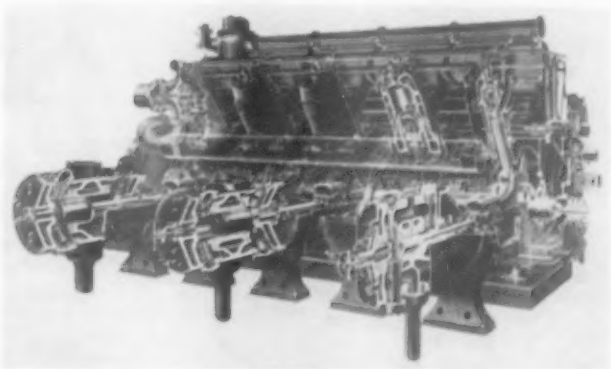
● *The first article in this series explained how the free-piston gas turbine works and gave some general facts concerning it. This article will (1) make a direct comparison between the free-piston unit and a conventional, crank-type engine of comparable size, and (2) give cost estimates for installing a 5,000-hp. pumping station.*

THE free-piston unit, let us say, is the test unit with heavy frame, 14-in. bore, and opposed-piston cylinder. Its outside diameter is about 48 in. and it is 20 ft. long. Attached to its side through a pipe is the power turbine, about 30 in. in diameter and 30 in. long, with the power-shaft coupling available to attach a load. It all weighs about 40,000 lb. and develops 1,500 hp.

Alongside of it, because of similar dimensions, is placed a well-known commercial engine used on pipelines. It has a 14-in. bore, and a 10-in. cylinder, V-type, two-cycle engine developing about 1,300 hp. It seems quite reasonable to select this particular engine because it is about the closest in cylinder size, body length, and horsepower that we can find.

This V engine has a crankcase about 22 ft. long and about 5½ ft. in diameter. It has 10 cylinders and cylinder heads, a crankshaft, and 10 connecting rods. It has five reciprocating scavenging cylinders, articulated. (Also furnished with a centrifugal blower as an optional arrangement.) It weighs 110,000 lb.

Author is assistant to engineering vice president, Cooper-Bessemer Corp., Mount Vernon, Ohio. Series material is from a paper presented at Los Angeles in September 1954 at the petroleum division conference of the American Society of Mechanical Engineers.



CONVENTIONAL engines have many more moving parts than free-piston engines.

The two plants are virtually equivalent in power and in basic cylinder size. They are both two-cycle engines.

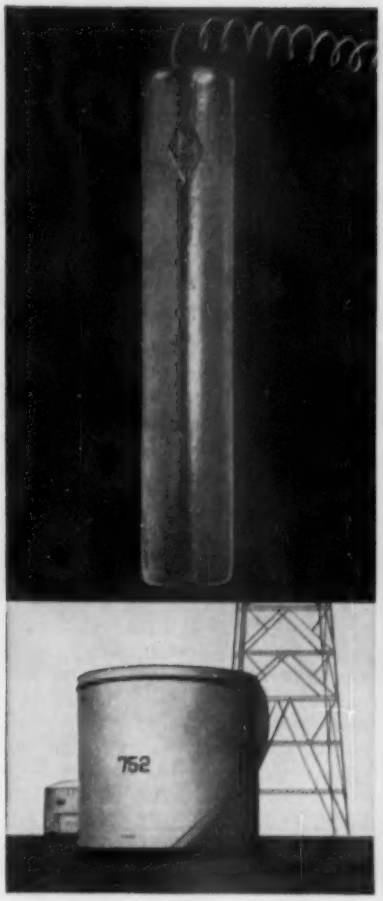
The crankcase of the V engine is just about equivalent to the whole frame of the free piston, including the center section, compressors, and bounce cylinders. The cylinders inside the free piston compare with 10 the power cylinders of the V engine. The 10-cylinder heads of the engine are not found in the free piston except for the two small covers that serve as bounce-cylinder heads. The 10-power pistons of the V engine correspond to the 2-power pistons of the free piston. The five reciprocating-scavenge pistons of the V engine correspond to the two compressor pistons of the free piston. The free piston does have two thrust rods between compressor pistons and the bounce pistons, but there are five scavenge piston rods and connecting rods in the engine plus 10 power-end connecting rods. There of course is no crankshaft nor any main or rod bearings in the free-piston unit. The low-temperature gas turbine of the free-piston engine corresponds somewhat in cost, but is much lighter than the crankshaft of the V engine. The synchronizing racks in the free piston are not in the engine, but these are not power members anyway.

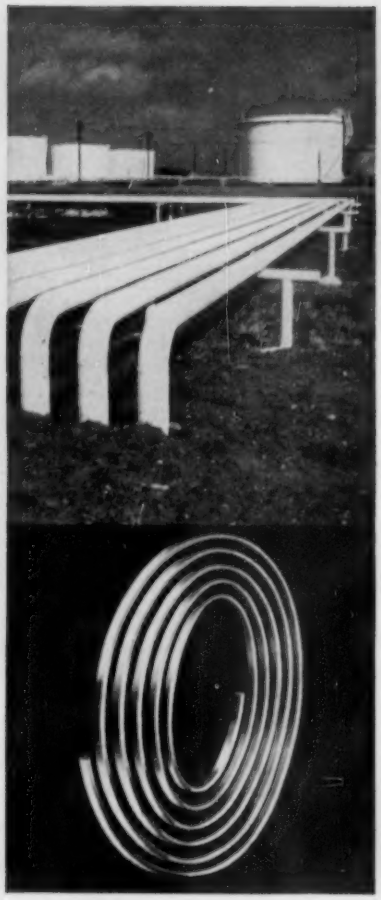
There is no need to elaborate upon this comparison. It speaks for itself. The great difference is brought about to a large extent by the lower cylinder output of the crank engines. The rotative speed of the engine is only about 60 per cent the cyclic speed of the free-piston unit, but the crank engine has inertia and torsional limits to its speed and load. The rest of the difference is in the specific cylinder output and the transmission efficiency in converting from the combustion cylinder to the load.

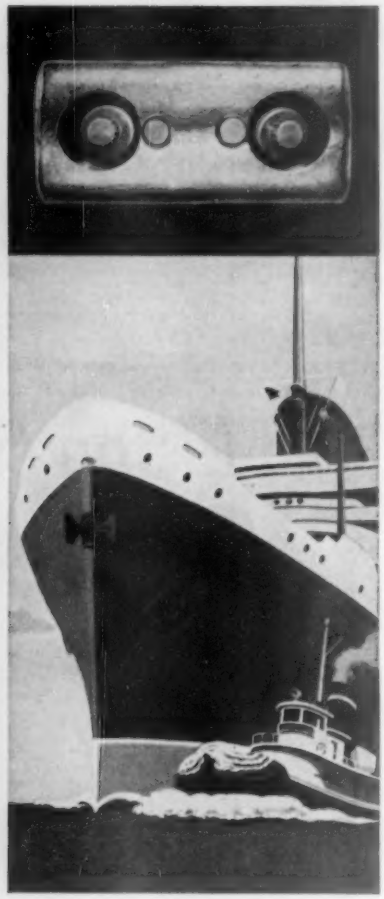
For many reasons, the piston speeds cannot arbitrarily be placed upon an equality. But granting that they could, and using the same bore, a common denominator can be approached—the cylinder performance. Obviously, in the above analysis, the weight of the comparison is heavily in favor of the free-piston engine.

The pressure charging of two-cycle engines was not feasible with mechanical supercharging. And the exhaust turbocharger had not been applied successfully in the two-cycle engine until quite recently. The free piston engine may have caused this activity since it amounts, in essence, to a pressure-charged two-cycle cylinder with power taken out of a turbine which restricts

DOW







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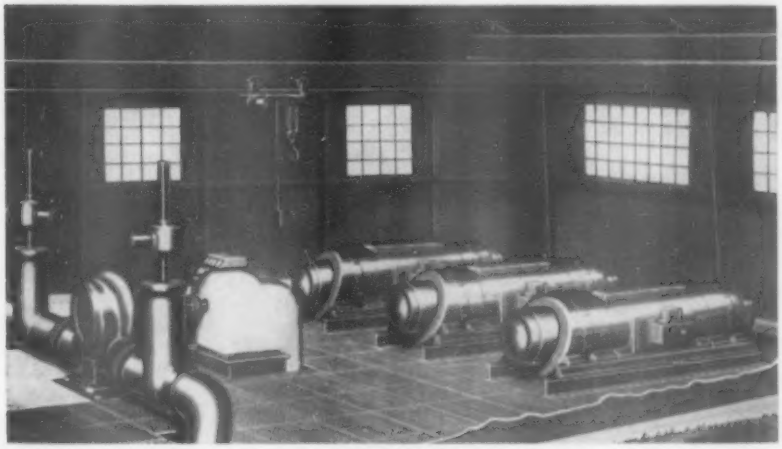

PIPELINE STATIONS using the free-piston gas turbine can be designed for almost any horsepower. Several free pistons can be compounded into one turbine.

the exhaust-port discharge of the cylinder.

Up to this point, it has not been difficult to cut through to the center of the problem. But from here on it is necessary to get right down to cases—because the future development of both free-piston and crank engines will be determined by cylinder outputs and the respective road blocks between the cylinder and the driven load.

High indicated pressures . . . In the free piston, 200 psi. m.i.p. is exerted directly on the piston assemblies to compress and deliver 523 lb. of hot gas per minute at 1,000° and 72.5 psig. to the turbine. This gas, expanded adiabatically to 12 psia., is capable of delivering 1,760 hp. With a gas turbine efficiency of 85 per cent, the turbine delivers 1,500 hp. to the load. Referring this back to the cylinder, this amounts to an equivalent b.m.e.p. of 186 psi. This performance corresponds to that of a crank-engine cylinder with 92 per cent mechanical efficiency. Crank engines seldom have over 85 per cent mechanical efficiency, so more of the free-piston cylinder's power is delivered out of an 85 per cent turbine to the load than that of a crank-engine cylinder direct.

This reasoning presupposes that a crank-type, two-cycle cylinder cannot only run as fast, but that it can carry 200 psi. m.i.p. The crank-type, two-cycle engine has never done better commercially than around 120 psi. with mechanical scavenging with uniflow. Without uniflow, it is generally below 100 psi. m.i.p. With the advent and development of turbosupercharging, where will these mean pressures limits go? The answer depends upon many things including bearings, rods, cranks, peak pressures, and temperatures.

The free-piston turbine in 14-in. bore is actually operating at 186 psi. equivalent b.m.e.p., and since the commercial engine is around 100 psi. b.m.e.p. at present, it seems that to increase this by 86 per cent will be a major undertaking. Let us, however, assume that the engine's crankshaft will let it run up to equal piston speed with the free-piston engine, and that its cylinder b.m.e.p.'s can actually go on up to 186 psi.

At this point, let us be clear that the 186 psi. equivalent b.m.e.p. in the free-piston cylinder is its normally aspirated power. Turbocharging the free piston merely amounts to applying a low-pressure turboblower on the exhaust from the turbine, to increase the mass flow of air through the free-piston compressor. Since the free-piston engine has a variable compression ratio (i.e., variable inner dead point of the power pistons), the normally aspirated mass flow can be doubled without materially increasing the peak combustion pressures or temperatures. It can continue to use a 1,000° turbine when turbocharged, and the net output will be doubled without increasing peak cylinder temperature or the temperature of gas to the turbine.

It is doubtful to some that turbocharged, crank-type, two-cycle engines can ever attain the cylinder performance of the free-piston cylinder normally aspirated. But free-piston engineers expect to double that output with turbocharging in the very near future. The thermodynamics of this cycle have been studied carefully for 3 years, and turbocharging appears to be sound and feasible at low cost.

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vantage, even though it is without the cranks, rods, and other parts mentioned in the previous analysis. Assume also that the crank-type, two-cycle engine can by some stretch of the imagination equal the normally aspirated output of the free-piston engine in both speed and i.m.e.p. (realizing that to do this, it would need a turbo as big as the free-piston turbine). Even with these assumptions, the turbocharged free-piston would still have a 2 to 1 advantage over the best conceivable two-cycle performance.

Four-cycle developers have gone past the 200 psi.-b.m.e.p. mark and are beginning to see the possibility of still higher mean effectives. The free piston normally aspirated is running with about 186 psi. mean effective on a two-cycle basis, which would amount to the equivalent of 372 psi. on a four-cycle basis. Free-piston development is toward doubling these mean effectives through turbocharging the compressor without increasing temperatures to the turbine and without losing thermal efficiency or durability.

From the above analysis, it may be seen that the free-piston engine's great cylinder-power-generating ability lies to a large extent in its tremendous energy releases, unrestrained by crank and rod stresses or bearings, and in its being equipped with simple means to control peak pressures. Some have compared it with a turbocharged two-cycle engine with rubber rods, adjustable in length while the engine is running, but this highlights only one of the free piston's charcteristics.

This analogy above between the V-type, two-cycle engine and the free piston is based upon equal cylinder bore and displacement, at equalized piston speeds. The same comparison will hold with smaller or larger engines and in any speed or life expectancy classification.

Basically, the free piston is intended to meet the growing demand for high-speed rotative drives and is not intended to invade the field of crank engines. It was rather directed toward steam and gas-turbine applications. It looks toward the advantages of high-compression combustion of heavy fuels without the ills of the continuous-combustion turbine, and toward installations outside the usual range of crank engines. The great advantage for large installations will probably lie in first cost, including installation charges. However, the small free-piston plant, to many, seems even more interesting.

The crank-type engines (either two or four-cycle) with vastly increased supercharging may conceivably, but very improbably, attain an ultimate per-

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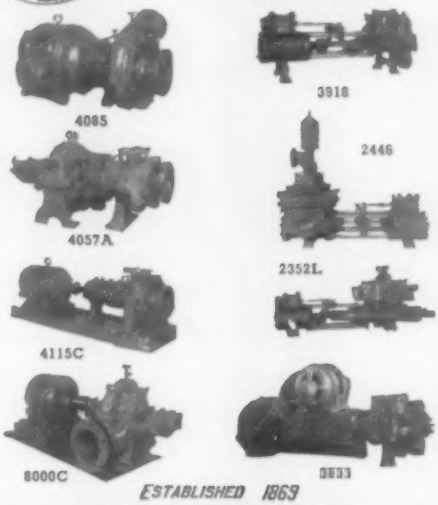

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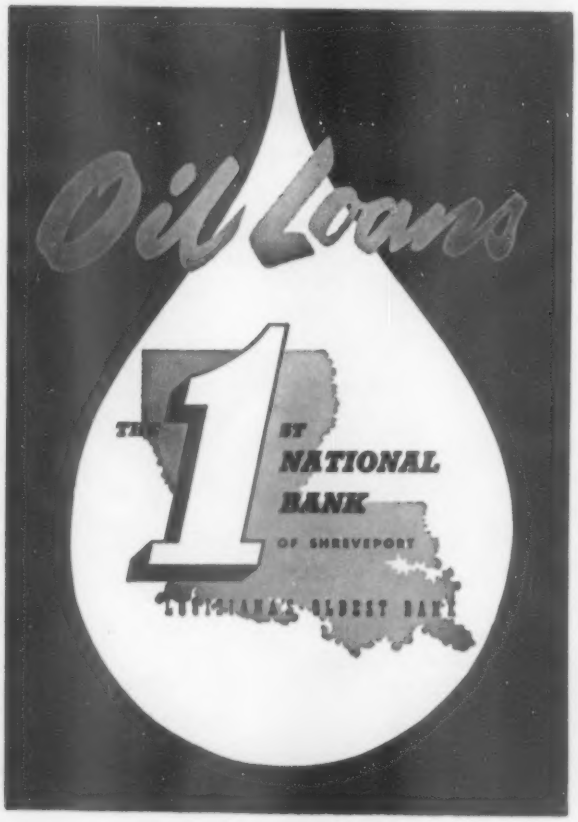

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formance that will approach that of the normally aspirated, free-piston engine. However, during the time the crankshaft engines are evolving upward, the free-piston engine will likely become turbocharged and move on upward toward some future position having nearly twice its normally aspirated output. This would involve little increase in physical or thermal stresses.

Therefore, the properly designed free-piston turbo may be expected to hold a long lead over the crank-type engine in weight per horsepower, bulk per horsepower, and in theoretically lower costs of production on the same basis of tooling. This may be as much as 35 to 40 per cent.

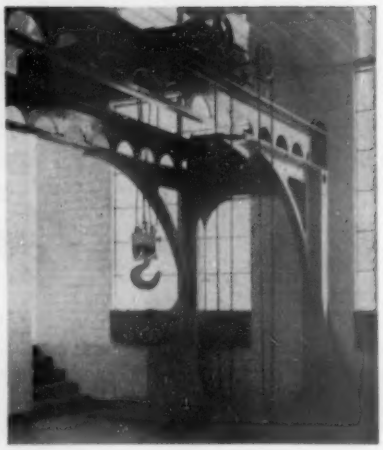
TABLE 1—POWER-UNIT SPECIFICATIONS

Free-piston gas generator, two-stroke, horizontal, opposed free pistons:	
Exhaust-gas horsepower, naturally aspirated	1,750
Exhaust-gas horsepower, supercharged	3,000
Exhaust pressure, full load, psig.	72.5
Exhaust temperature, full load, °F.	1,000
Power cylinder diameter, in.	14
Nominal stroke, in.	18.5
Cycles per minute	555
Thermal efficiency on gas horsepower basis, per cent	45
Gas turbine, reaction type, five-stage:	
Shaft horsepower at 85 per cent efficiency	1,500
Inlet pressure, full load, psig.	72.5
Inlet temperature, full load, °F.	1,000
Gas flow, psi. per hour	32,000
Turbine speed, r.p.m.	14,400

TABLE 2—COST ESTIMATE FOR TYPICAL OIL PUMPING STATION

(With 5,000 hp. installed, using three free-piston gas turbines driving centrifugal pumps)

1. Land and improvements: Not included	
2. Structures:	
A. Pumping-station building	$46,900
B. Shop and warehouse building	22,100
C. Water-well building and equipment	21,300
Total	$90,300
3. Equipment and piping:	
A. Main engines, turbines, gears, and pump	$296,250
B. Electric equipment and installation	29,550
C. Fan-cooled radiator equipment	28,100
D. Mechanical equipment installed	113,800
E. Main oil piping and manifolds	128,800
Total	$596,500
Station total	$686,800
Unit investment, per b.hp.	137



Crane combines utility and beauty

GANTRY cranes like the one above are installed in 13 pump stations of a large southeastern pipeline company as a necessary aid to maintenance work on pumps and motors. Besides being extremely useful in maintenance work, the cranes are designed to offer a minimum of interference with the otherwise uncluttered appearance of the stations.

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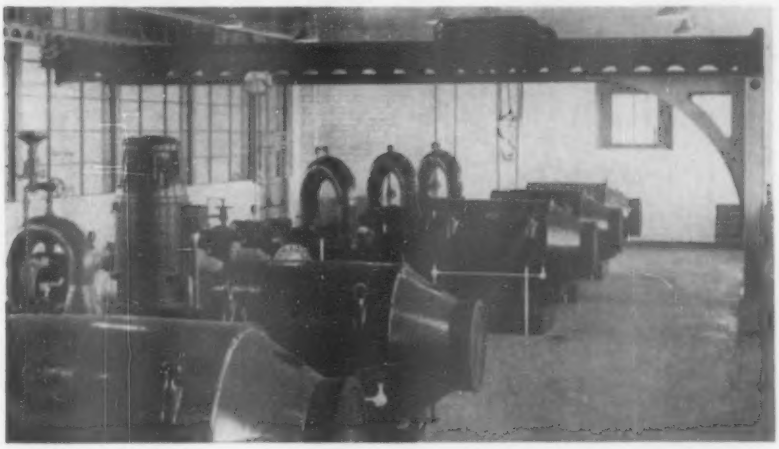

GANTRY CRANES make for easy maintenance on heavy parts of pumps and motors.

appearance of the pump stations, gantry cranes were chosen by the designers as being best suited for permanent installation. While a standard overhead crane with well-mounted rails on each side could have been used, there were objections to having the front windows, which extend to the ceiling, obstructed by having a crane rail across them. Hence a floor-mounted support was used along these windows.

The cranes were installed during a recent major station-expansion and line-looping program of the pipeline company. Major building modifications would have been necessary to allow the new cranes to serve the original pumping units, therefore the cranes are used on the recently added pumping units only.

The gantry cranes were designed and manufactured by the Cleveland Tramrail Division of The Cleveland Crane & Engineering Co.

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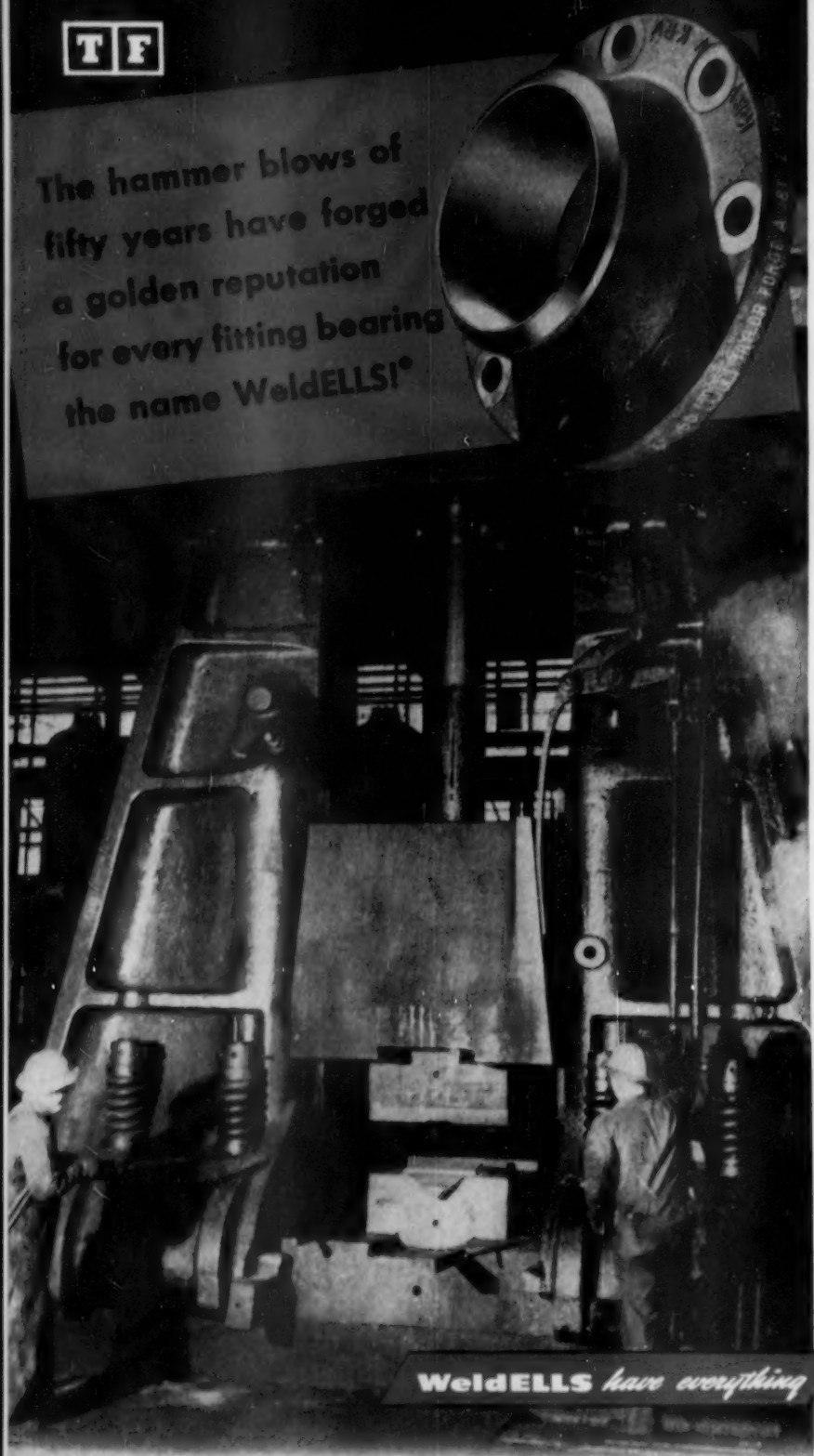

WeldELLS *have everything*

Both hammers were the largest of their time

These two forging hammers went into service some 40 years apart, yet they boast the same claim to distinction: both were the largest in the world when they went to work for Taylor Forge. The hammer above was largest in the world of 1910. The hammer at the left is largest of its type in operation in the world of *today!*

The old hammer, now extensively rebuilt, is on well-earned semi-retirement in our Chicago plant; but it still stands as a symbol of the vigorous pioneering spirit that gave industry its first forged steel flanges on a commercial scale. It helped to forge out the first lap joint flanges for Van Stone joints. It saw the first engineered slip-on flanges; the first welding-neck flanges; the first forged welding necks and pressure-vessel nozzles; the first complete line of seamless, butt-welding fittings.

Since it struck its first blow other Taylor Forge hammers have been successively the world's largest, but "Old Number One" saw all the steps that made Taylor Forge the leader in designed piping progress.

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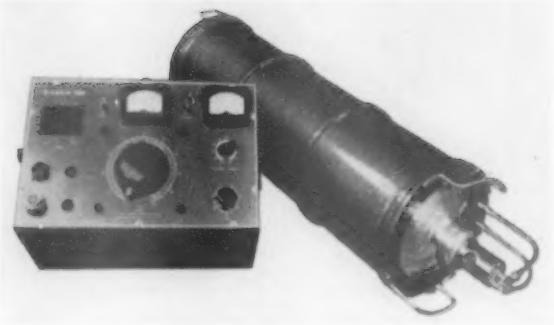
by Dan B. Miller



New X-Ray Unit Is Made for Pipelines

A new, portable unit is for complete circumferential X-ray of weldments and construction of pipelines, castings, boilers, tanks, and similar equipment in the field and in industrial plants. The high-powered, lightweight unit, called the X-Tron 180, contains a specially designed transformer and X-ray tube and a high-voltage generator that delivers 180 kv. and 10 ma. continuously.

The unit will penetrate 2⅛ in. of steel and will traverse a pipeline greater than 12 in. in diameter. In addition, it can be placed in the center of a ring of castings so that they all can be X-rayed at one time.

The X-ray tube is of the end-ground type with the option of a 360° target or a single beryillium window. All parts can easily be replaced and the transformer is designed so that replacement cost is low.

The X-Tron 180 contains a compensating device for line fluctuation, special provision for cooling, and the unit is safeguarded against overloading either thermal or electronic. Rayproofing is equivalent to at least 2.5 mm. of lead. The control panel is semiautomatic and can be operated by relatively inexperienced personnel and the unit can be placed in a car and transported easily to the job. All controls are weatherproof. *Mitchell Radiation Products Corp.*

Check No. 1 On The Time-Saver Card

Hydraulic Winch Is Remote Controlled

A new lightweight, compact hydraulic winch can be installed in almost any location and controlled remotely as the power source can be located at a distance from the winch. This eliminates rigid drive shafts, pillow-block bearings, sprockets, chain, and levers.

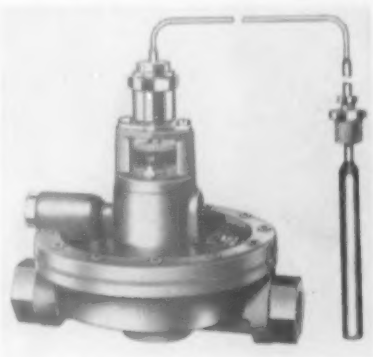
The versatile winch can be installed on trucks and other vehicles where power takeoff openings are not available. Basic advantages of this new winch are the precise control of loads and the elimination of shock loading by ultilizing the smooth hydraulic action. All drive parts are enclosed emphasizing the safety and maximum life of the winch. *Tulsa Winch Division, Vickers, Inc.*

Check No. 2 On The Time-Saver Card

New Thermostat Stops Oil Loss and Failures

A new single-unit heater-treater control system regulates and holds temperature precisely, regardless of climatic changes and operates indefinitely despite sour gases. Developed specially to meet oil-field problems, the compact Model 86 system features a mercury-actuated control valve and a built-in mechanical pilot valve. Operating in the 50° to 350° F. emulsion heater range, the system is also available in nine other temperature ranges, from —30° to 1,200° F. The control valve, available in ¾ and 1-in. sizes, handles gas pressures up to 100 psi.

Exceptional accuracy is obtained through direct, positive action of the control valve's mercury-filled thermostatic element. Carried in a socket which extends into the control point of the heater or tank, the mercury expands or contracts with temperature. The mercury acts through a flexible capillary tube to position a plunger bearing upon the small pilot valve. In turn, the pilot valve controls the opening or closing of the diaphragm-operated main valve.



When the thermostatic element calls for heat, the pilot valve opens to allow accumulated gas pressure to bleed from the diaphragm top, causing the diaphragm to rise. This opens the main gas valve and supplies the burner with fuel. Once desired temperature is reached, the pilot valve closes, causing

gas pressure to again accumulate and to force down the diaphragm top. The pilot valve stem is adjustable by means of the dial which shows the temperature setting.

Nylon-Hycar diaphragms protect the mechanism from sour gases, isolating the mercury-bulb element, its plunger, the linkage, and the dial adjustment from contact with bleed-gas flow through the pilot valve. Other parts exposed to gas flow are stainless steel or cast gray iron, both of which are inherently self-protective against the hydrogen sulfide in sour gas. *Partlow Corp.*

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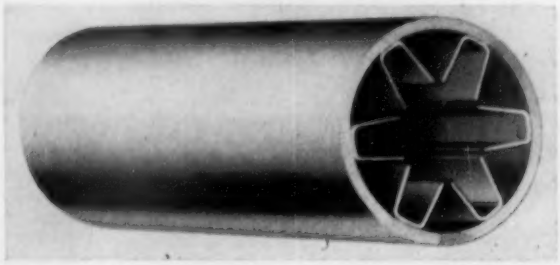

New Boiler Uses Internally Finned Tubes

This new boiler reflects the company's 17 years of successful experience applying the advantages of extended-surface, finned tubes to the exacting heat-transfer problems of the chemical and petroleum industries. These proven economies have been applied to transferring heat in boilers.

As illustrated, the internally finned tubes produce a fire-side to water-side surface ratio of about 3 to 1; as compared to fire-side to water-side ratio of only 1 to 1.1 for plain bare tubes. Thus internally finned tubes provide almost three and one-third times more surface area than plain bare tubes to pick up the heat and transfer it to the water. In addition, the internal finning increases the turbulency of the hot gases, and brings them into much more intimate contact with the heat-transfer surface than is possible in a plain, bare tube.

A Brown Fintube 100-hp. boiler with internally finned tubes is only about two-thirds as wide; two-thirds as long; and two-thirds as high as a bare tube boiler of equal capacity. These small and compact boilers can be installed where headroom is limited with consequent additional savings in building costs. Due to the high heat-transfer rates of the finned tubes, the boilers are said to come up to full steam pressure in about 10 minutes. The boilers are completely self-contained, modular units. Any number of boilers can be connected together with interlocking controls to provide any capacity a plant may need. *Brown Fintube Co.*

Check No. 4 On The Time-Saver Card

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Jet Gun Has Increased Perforation Effectiveness

A newly engineered 4-in. jet-perforating gun has greatly increased effectiveness over conventional jet methods. The Western Rocket jet gun involves a new principle in positioning the jet charges within the gun. The new positioning provides a more effective utilization of the jet force, and also shortens the length of the prima cord between charges which permits the use of a larger jet charge.

Tests fired in standard targets of 20-lb., 5½-in. casing and 72-hour neat cement show decided increases in size of the entry hole, penetration, and hole volume. The entry hole is approximately .45 caliber in size. Penetration is increased from 8 to 10 per cent, and hole volume is increased as much as 81 per cent. This results in approximately 45 per cent more formation face being exposed within the perforation.

The larger, deeper hole will clean up more quickly after perforating. It also causes less restriction to flow, thus providing easier access to the formation for high-viscosity fluids used in fracturing or for fluids used in high-injection rate treatments, both fracturing and acidizing. Coupled with these benefits is the full protection to the casing derived from the use of a retrievable tubular gun. *Western Co.*

Check No. 5 On The Time-Saver Card

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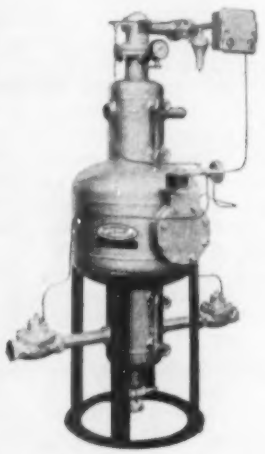
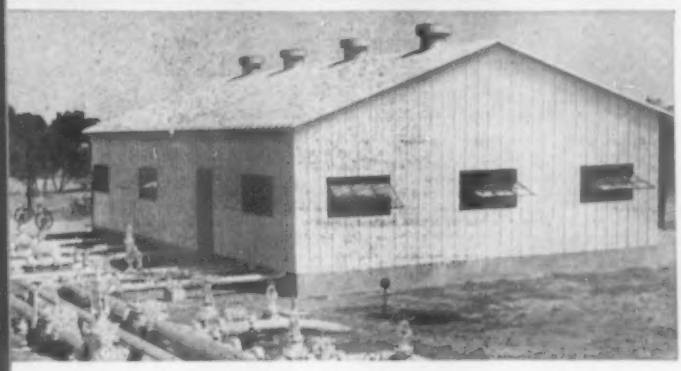
Vol-U-Meter Meters Crude Runs More Accurately

Accurate metering of crude runs to storage is provided by a new type of metering vessel marketed under the trade name of Vol-U-Meter. This unit measures liquid by cyclic accumulation, isolation, and discharge of equal volumes, with the number of cycles registered and totalled on a mechanical counter. Since each cycle represents a known volume of liquid, it is a simple matter to determine the total volume that passes through the vessel during any period of time.

Liquid levels are controlled in Seraphin necks whose volumes are very small as compared with that of the main accumulation chamber. This design assures uniformity of the unit volume that is discharged at each cycle, and contributes toward the very high accuracy of the vessel, which has been determined to approach 99.8 per cent in actual field operations.



Vol-U-Meters are furnished in two types: Type C with an external piston or rotary snap-acting pilot, for operating pressures of 125 and 230 psi.; and Type B (illustrated) with torsion-tube, liquid-level control for operating pressures of 125, 230, 600, 1,200, 1,500, and 2,000 psi. Both types are furnished in sizes that dump 1/10, ¼, ½, 1, 2, 5, and 10 bbl. per cycle. Liquid capacities per 24 hours range from 0 to 144 bbl. for the smallest size; and from 0 to 7,200 bbl. for the largest. Both types in all sizes can be calibrated



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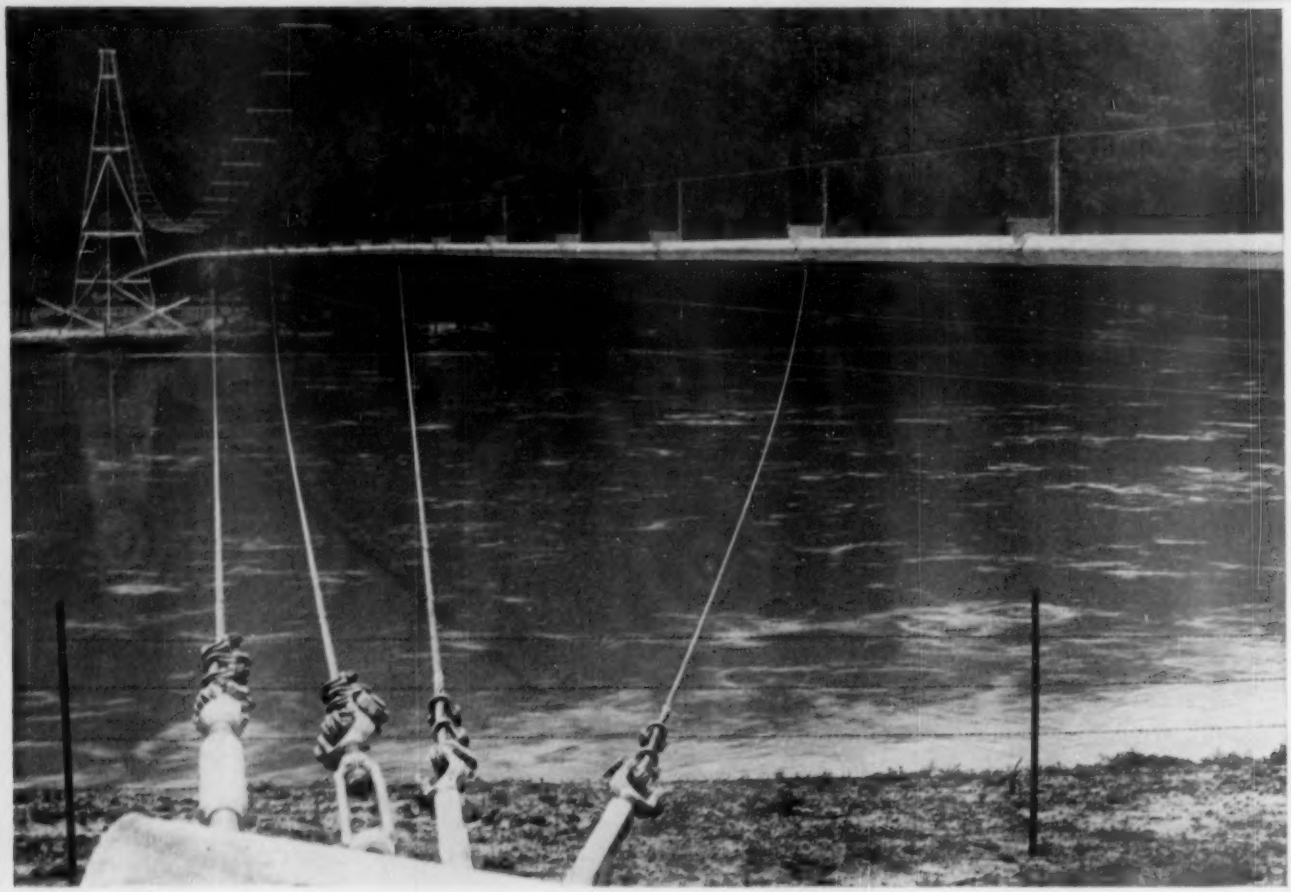

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while the unit is in service. *Oil Metering & Processing Equipment Corp.*

Check No. 6 On The Time-Saver Card

●

Strap-on Plug and Clamp Speeds Pipeline Repairs

A new neoprene-rubber, strap-on plug-and-clamp assembly is especially designed to stop leaks before affixing

and welding the shoe to damaged pipelines. The neoprene plug is laminated to a perforated steel strap with a steel disk supporting the back of the plug. The pliable softness of the plug allows it to flow readily into all cavities, pits, and cracks for a tight seal, yet is strong enough to withstand high pipeline pressures.

The clamp applies the plug to the leak in seconds. The holes in the strap fit over pins on the clamp; the clamp is tightened, and the plug seals the leak. The clamp is easily removed after the pipe shoe is welded in place. Plugs come with straps 24 in. long for pipes 8 in. or less in diameter, 36 in. long for pipes up to 12 in. in diameter. *D. W. Moor Rubber Corp.*

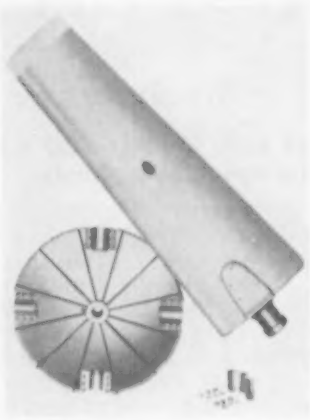
Check No. 7 On The Time-Saver Card

●

New Fan Increases Tower Efficiency

Increased efficiency, strength, and stiffness result from a new blade design now being used for Hartzite plastic cooling-tower and heating-exchanger fans in 14 to 22-ft. diameters.

These improvements are achieved by the use of a tapered blade which is considerably thicker at the shank than at the tip. A heavily reinforced leading edge increases stiffness and practically eliminates sag. Building up of the leading edge also produces a tear-drop



cross-section which smooths out air flow over the blades and produces increased air deliveries.

Hartzite plastic has been proved in many of cooling-tower and heat-exchanger installations as a material of exceptional strength and durability. It absorbs vibration and is highly resistant to corrosion and abrasion. And if the surface of the Hartzite blade is damaged, the interior has the same high resistance to corrosion and mechanical damage. *Hartzell Propeller Fan Co.*

Check No. 8 On The Time-Saver Card

●

New Casing Hanger Eliminates Overlap

A new casing hanger eliminates casing overlap, thus saving pipe. This casing hanger suspends pipe in perfect alignment and its slip design has no drag springs. It is possible to suspend the oil string in tension and it will not collapse of its own weight. It will not buckle or shift position in the well, sink into the bottom formation or bend into cavities. The hazards of casing contacting the wall of the hole are eliminated.

Also successful cementing is assured as no time is lost in making up overlapped casing or making up extra surface-circulating connections. Instead of the conventional tapered cone used to force slips outward, the new construction provides specially broached, single-plane runners on which slips travel with a full 100 per cent backup contact at all positions.

These casing hangers are now available in all popular sizes. *Burns Tool Co.*

Check No. 9 On The Time-Saver Card

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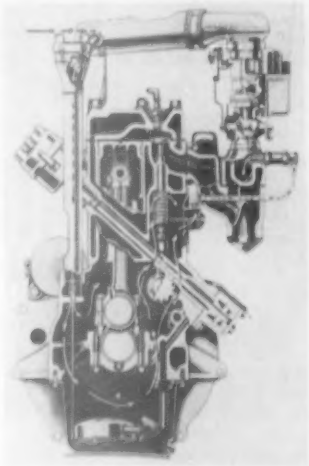
Crankcase Ventilation Lowers Maintenance Cost

Willys first used positive crankcase ventilation during wartime in their Jeep engines. This same design is now being



installed on the Willys four and six-cylinder Power Giant industrial engines, used in pumping and other oil-industry applications.

Positive crankcase ventilation makes internal air circulation independent of the engine's physical motion relative to the external atmosphere. Willys type ventilation automatically regulates internal air flow to engine speed. Air is pulled in through the air filter to remove all harmful dust and dirt particles that would normally cause oil sludge. It passes into the oil-filter tube and circulates freely within the engine block removing oil-thinning or acid-forming condensates. This type ventilation helps lower maintenance costs and provides longer engine life. *Willys Motors, Inc.*

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Oil Tool Division Price List. Catalog 1002, perforated for loose-leaf bindings carries extensive detail on: three-cone rock bits for all formations, piloted reaming bits, reamers, drill collars, tool joints, subs, junk baskets, and lifting plugs and subs. The catalog also presents a listing of all sales outlets. *Chicago Pneumatic Tool Co.*

Check No. 11 On The Time-Saver Card

●

Permutit Reboiling Deaerator. The many advantages of the reboiling deaerator with direct-contact, internal-vent condenser, which heats and deaerates water in three stages are outlined in a four-page Bulletin No. 3677. This device is a highly efficient unit, which operates equally well over a wide range of flows from 1 to 100 per cent of rated capacity. It effects a thorough removal of residual noncondensible gases and reduces dissolved oxygen in the effluent to less than 0.005 ml. per liter. The direct-contact vent condenser does not require bypass piping, saves head room, and reduces maintenance costs by eliminating the need for cleaning or replacing tubes. *Permutit Co.*

Check No. 12 On The Time-Saver Card

●

Rubber-Bronze-Bushed Flexible Couplings. A new, handy, pocket-size selection guide, Bulletin 57 contains technical data, ratings, drawings, specifications, service factors, plus information on the various uses of Ajax rubber-bronze-bushed flexible couplings. *Ajax Flexible Coupling Co., Inc.*

Check No. 13 On The Time-Saver Card

●

Liqui-Moly H.P. Thread Compound. A new Liqui-Moly silicone high-pressure thread compound is a modification of the recently announced A.P.I. high-pressure thread compound, developed by Mellon Institute for the American Petroleum Institute and recommended by them to members for all oil-field uses. The modification consists of the use of molybdenum disulfide in place of the graphite in the Mellon

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2-9878

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3-5059

formula, and the addition of a corrosion inhibitor. Exhaustive field tests of the latter compound have demonstrated its effectiveness in sealing drill pipe, line pipe, casing, and fittings in oil-field use, particularly in deep wells and high-pressure gas systems. Technical Bulletin No. 26-A describes the new compound. *Lockrey Co.*

Check No. 14 On The Time-Saver Card

●

Outboard Propulsion and Steering Units. This new 12-page catalog illustrates and covers in detail Harbormasters which are complete marine power and steering units, in one package, easily installed for immediate use. Models range in size from 40 to 400 hp. gas or diesel. Included in the new catalog are features of design and construction, specifications, and many photos of Harbormasters in action on such craft as barges, tow boats, ferries, dredges, and lighters. *Murray & Tregurtha, Inc.*

Check No. 15 On The Time-Saver Card

●

1940-1954 Index to Allis-Chalmers Electrical Review contains four pages of index of titles, a six-page subject index, and a five-page index of authors. Subjects indexed are: balancing, betatron, central-station problems, circuit breakers, control, Dynamometers, electronics, generators, hydroelectric machinery, materials, mathematics and theory, motors and motor applications, regulators, switchgear, transformers, transmission systems, gas and steam turbines, unit substations, and welding. *Allis-Chalmers Manufacturing Co.*

Check No. 16 On The Time-Saver Card

●

Audigage Thickness Testers. This catalog brings together all current information previously published in several other articles and adds new information not previously available. A table summarizes characteristics and applications of the five models. Construction of various transducer types is illustrated by sketches. Audigage instruments employ ultrasonic energy to measure the thickness of dense materials, such as metals and certain plastics, nondestructively from one side. The instruments are portable and battery-powered, and may be used with cables up to 100 ft. in length connecting the transducers to the instrument itself. *Branson Instruments, Inc.*

Check No. 17 On The Time-Saver Card

●

Hot-Spray Application of Vinyl Paints is an article by B. C. Wright, mainte-

Progress Report

to users and prospective users of NATIONAL

(CAST IRON)

R. A. SPECHT
Manager

COOLING AND CONDENSING SECTIONS

The following new developments in National Cooling and Condensing Sections are announced in the interest of effecting further operating economies and performance value:

1. SHOP ASSEMBLY. National Sections, while easily and economically assembled in the field, can now be shipped assembled in stacks, tested and ready for use, at surprisingly little extra cost This now applies to domestic shipments as well as for overseas.

2 PROTECTIVE COATINGS. For services where cooling water is excessively corrosive or fouling, National Sections coated with recently developed Kolmetal have proved to be unsurpassed in increasing life and long range efficiency plus reducing maintenance costs for cleaning to virtually zero.

3. EVAPORATIVE OPERATION. It is now a proved fact that National Sections can be operated as a combination exchanger and cooling tower, with excellent approaches between ambient wet bulb and final product temperatures.

4. FURTHER RESEARCH. Now under consideration and development are several new materials from which National Sections may be cast, in addition to currently available close grained gray cast iron and chrome nickel iron. These developments will be of particular interest in connection with the handling of flammable fluids. Further announcements in this field will be forthcoming soon.

These new developments plus the fact that National Cooling and Condensing Sections are performing in many industrial, chemical and oil field and refining applications with high efficiency and with minimum maintenance prove that it pays to consult with National about your cooling and condensing problems. Write for our latest Bulletin CEC-54.

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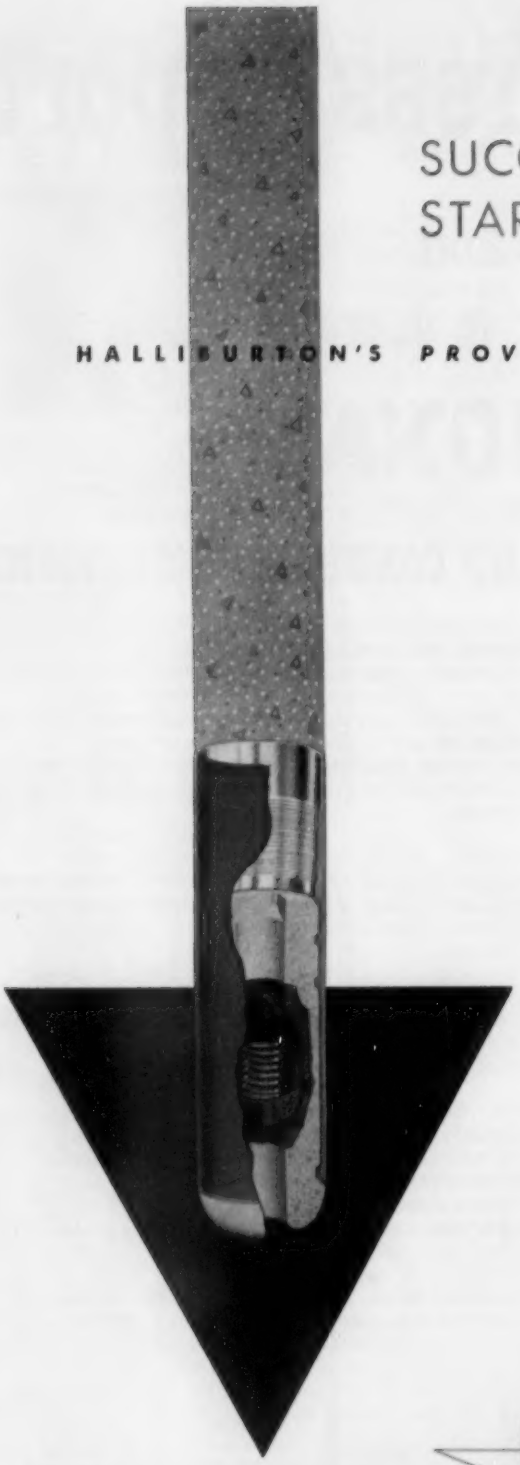

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HALLIBURTON'S *PROVED* FLOATING EQUIPMENT

The most important improvement in modern floating equipment—Halliburton's new Super Seal valve—has been proved to be the *one* valve that can consistently give a fluid-tight seal and enduring, efficient operation under any condition. During 12 years of complete tests and field use, the Super Seal valve has successfully shut out contaminating cement and fluids under the rugged conditions that cause ordinary valves to fail.

Super Seal valves, now used in the new Halliburton Floating Equipment, have a new conical design that can take higher pressures and heavier wear without leaking or wearing. Even after extreme tests that subjected the new valve to hours of continuous abuse by viscous slurries and pressures up to 15,000 p.s.i., the Super Seal gave a perfect leakproof shut-off every time with no leakage, no fouling and no damaging wear. Combined with a safer guide design, a shock resistant concrete collar of higher compressive strength and faster drillability, the Super Seal valve makes new Halliburton Floating Equipment the most efficient cementing aid available anywhere!

And Halliburton's program of research and development will continue to provide new improvements for floating equipment. But all changes will be thoroughly tested in the labs and in the field *before* being introduced—just as Super Seal was thoroughly tested and proved. Call for the floating equipment you can trust, Halliburton's Super Seal, from the world's most experienced cementers. Call your local or district office of the Halliburton Oil Well Cementing Company.

HALLIBURTON

CEMENTING SERVICES

211 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

nance engineer, Carbide & Carbon Chemicals Co., on equipment and methods of applying vinyl-based paints on plant equipment to combat corrosion. The article covers hot application and an evaluation of equipment, method, and coating materials. *The Spee-Flo Co.*

Check No. 18 On The Time-Saver Card

●

Stainless-Steel Floor Grating. A six-page, four-color brochure, No. 14-R, illustrates a rustproof, chemicalproof, nonmagnetic, heat-resistant, corrosion-resistant grating for walkways, platforms, and stairways in industrial applications. Engineering data tables offer the design engineer complete specifications. *Kerrigan Iron Works, Inc.*

Check No. 19 On The Time-Saver Card

●

Manual of Records Management. A program of scientific record keeping is introduced in this extensive manual. General subject matter includes: organization for records management, procedures for administering the program, recommended retention periods, statutes of limitations, and microfilming. *Dolin Metal Products, Inc.*

Check No. 20 On The Time-Saver Card

●

Electrical Precipitation, a 28-page bulletin describes electrical precipitation equipment. The bulletin outlines the general principles of electrical precipitation equipment and individual sections are devoted to its chief application: power plants, manufactured gas, oil refineries, carbon black, and miscellaneous metallurgical. Installation photographs and diagrams supplement the text. *Research-Cottrell, Inc.*

Check No. 21 On The Time-Saver Card

●

Safety-Equipment Catalog is designed to give complete information on all Bullard safety products in a quick and efficient manner. On all pages clear photographs of the items being explained are shown along with easy-to-read technical data. The back page of Catalog No. 55 lists all addresses and phone numbers of Bullard distributors. *E. D. Bullard Co.*

Check No. 22 On The Time-Saver Card

●

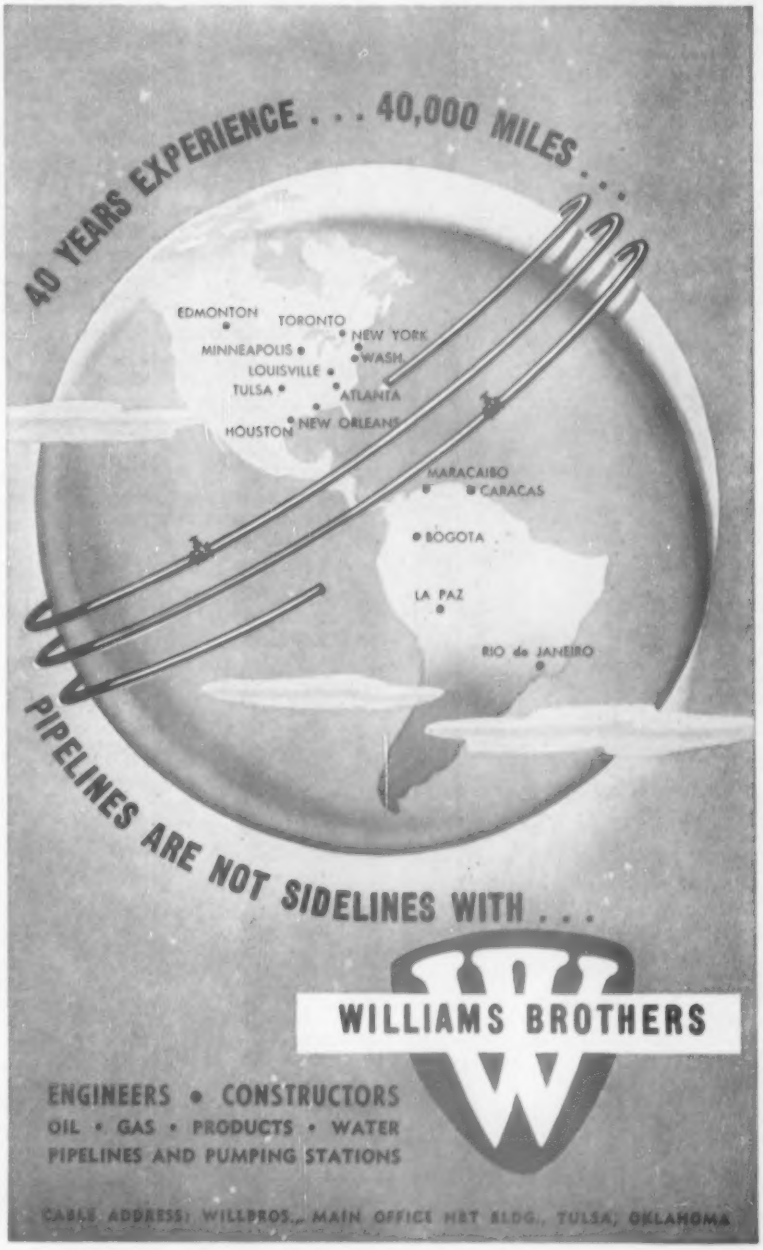
Long Arms for Your Tractor. Owners of tractors equipped with a two-drum winch will be interested in the specifications and information in Bulletin No. 160. The bulletin gives scraper and slackline bucket sizes for tractors from 40 to 150 hp. Maximum spans, line speeds, and capacities in cubic yards are also shown. Tractor-powered Sauerman scraper machines can work in places that do not allow the head room other machines require, as well as over surfaces that will not support greater weight. The slackline cableway gives owners a long-range excavator with very little additional investment. *Sauerman Bros., Inc.*

Check No. 23 On The Time-Saver Card

●

Norelco Autrometer. A new four-page folder fully describes the principle and operation of a new instrument for automatic analysis of incoming raw materials, constituents in various stages of combinations, and the finished products. Illustrated with photos and diagrams, the folder tells how the automatic multielement indexing spectrometer for process and quality control works. Separate sections discuss performance, operation, industry use, sequential goniometer, sample and standard holders, detectors, X-ray tube, and high-voltage transformer. A full-page block diagram printed in five colors clearly indicates functions of various components. *North American Philips Company, Inc.*

Check No. 24 On The Time-Saver Card



EQUIPMENT MEN . . . in the News

Johnston Testers Opens Sales Office in Denver

W. GORRELL

J. E. Smith, vice president of Johnston Testers, announced recently that the company had opened a new sales office in Denver to maintain closer contact with operating offices in the Denever, Salt Lake, and Casper, Wyo., areas. Wayne Gorrell has been transferred from Casper to the new office in Denver.

Oilwell Makes Gammello Area Merchandise Manager

C. D. GAMMELLO

Promotion of Charles D. Gammello to area merchandise manager at Columbus, Ohio, has been announced by C. H. Maynard, eastern area manager for U. S. Steel's Oil Well Supply Division. Gammello moves to his new Columbus headquarters from Charleston, W. Va., where he has been assistant to district merchandise manager since 1951. Joining Oilwell in 1937, the new area merchandise manager serves as manager of numerous stores over the eastern area. In 1949 he was named district material supervisor at Charleston.

Johnston Pump Purchased By Emsco Manufacturing

Johnston Pump Co. has entered into a contract providing for the sale to Emsco Manufacturing Co., Los Angeles, Calif., of most of the assets of Johnston Pump Co., effective January 31, 1955.

Emsco is one of the foremost manufacturers of oil country drilling and pumping machinery and equipment. Approximately 85 per cent of the outstanding stock of Emsco is owned by Youngstown Sheet & Tube Co. and its wholly owned subsidiary, Continental Supply Co.

Johnston Pump was founded in 1909 and has grown to the one of the largest independent vertical - turbine - pump manufacturer in the world, with its main plant in Pasadena, Calif. and manufacturing facilities in Mexico and India.

It is the intention of Emsco to operate Johnston substantially in the same manner as in the past.

Evans Named Byron Jackson Regional Sales Manager

The appointment of R. J. Evans, Jr., to Mid-Continent regional sales manager for Byron Jackson's oil tool division has been announced by Robert T. Harcus, executive vice president of Byron Jackson Co. Evans succeeds B. A. Hilliard.

As a 10-year member of the BJ sales organization, Evans is well known in the oil industry. Prior to his new appointment, he served as sales manager for the hydralift pump division of Byron Jackson. Headquarters for BJ Mid-Continent sales activities are in Fort Worth, Tex.

Norris Announces Three Management Promotions

G. W. DAVIDSON

Edw. C. Bolger, president of W. C. Norris Co., has announced that effective January 1, 1955, G. W. (Bill) Davidson has been promoted to vice president in charge of sales. Art Miller has been advanced from assistant sales manager to sales manager, and Paul Hagaman, Tulsa sales, became assistant sales manager.

A. MILLER

P. HAGAMAN

Davidson has been with Norris for 19 years, coming to Tulsa as city salesman from the Wichita Falls, Tex., territory in 1944, advancing to sales manager in 1946. Miller handled Tulsa city sales prior to becoming assistant sales manager. Hagaman served as branch manager at Salem and St. Elmo, Ill., before moving to Tulsa in March, 1954.

Welex Jet Marks Tenth Anniversary This Month

R. O. SHAFFER

Welex Jet Services, Inc., well-servicing firm, Fort Worth, Tex., is celebrating its tenth anniversary with the familiar oil-country invitation to its customers, stockholders, and employes to "have a cup of coffee with us today." The invitation was made on a card with 10 cents attached.

According to Ray O. Shaffer, president of the company, Welex was incorporated in Texas an January 6, 1945, under the name of Well Explosives, Inc. The company was founded by a group of Texans to develop a more effective method of casing perforating and open-hole shooting. These men conducted investigations and experiments along the principle demonstrated by the bazooka rocket used in World War II. Work was begun on the problem of adapting shaped charge principles to oil-well casing perforating.

Patent rights were acquired and the services of experienced technical personnel were obtained. In early 1947, other experienced well-servicing firms were licensed, and at present 21 firms are licensed under the patented Welex process to perform throughout the oil fields in the world.

The first Welex field stations were opened in 1947 at Odessa and Wichita Falls, Tex., and Ardmore, Okla. It wasn't long before additional field stations were opened in other areas until now there are 17 with 3 division offices in Midland and Houston, Tex., and Oklahoma City.

Early in 1949 Welex introduced the torpedo-jet process for open-hole shooting in wells where casing has not been set through the potential oil-bearing formation. Another step was taken when the company constructed a modern manufacturing plant for making jet guns, torpedo-jet charge carriers, shaped charges, and other items used in well-servicing operations.

In 1952, under agreement with Well Surveys, Inc., Tulsa, Welex Jet inaugurated radioactivity well - logging service operations, a method of plotting gamma-ray and neutron curves in oil wells.

Utilizing facilities at the charge manufacturing plant near Arlington, Tex., Welex Jet is now engaged in research efforts to further improve the jet perforating and torpedo-jet shooting and to perfect other applications of jet principles to oil-field use. Also at Arlington, charges are sampled and test-fired to insure uniform maximum quality for field operations.

The next year, 1953, was a particularly active one for Welex Jet. Early in the year the organization purchased all assets of Well Perforators, Inc. Also in 1953, Welex management purchased the patents for a wire-line squeeze-cementing tool. This development enables an operator to correct many of the water problems encountered, and to shut off perforations and plug back. A new home office was built in 1953 and Welex engineers invented, developed, and tested a new tool, the formation-fracturing tool. This tool utilizes the principles of jet perforating, but eliminates the limitation of small powder charge by firing a projectile vertically down a well through a 20-ft. barrel and directing the missile around a curved channel so that it enters the formation horizontally. By this means the tool can use a powder charge measured in feet. Activity in 1953 continued with the opening of the first Kansas station at Great Bend, Kans., and the development of a tilting-shaped charge-tubing gun to be used in connection with permanent well completions.

At present Welex Jet offers six basic services to the oil industry: jet perforating of steel pipe; open-formation shooting; radioactive well logging; formation fracturing; wire-line sqeeze cementing; and setting of bridging plugs and packers.

In 1954 the company was reorganized and expanded under the laws of Delaware. This enabled a million dollar stock offering to be made to company stockholders for new capital which will allow continued expansion.

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Bethlehem Supply Announces Tubular Sales Appointments

W. F. TAYLOR

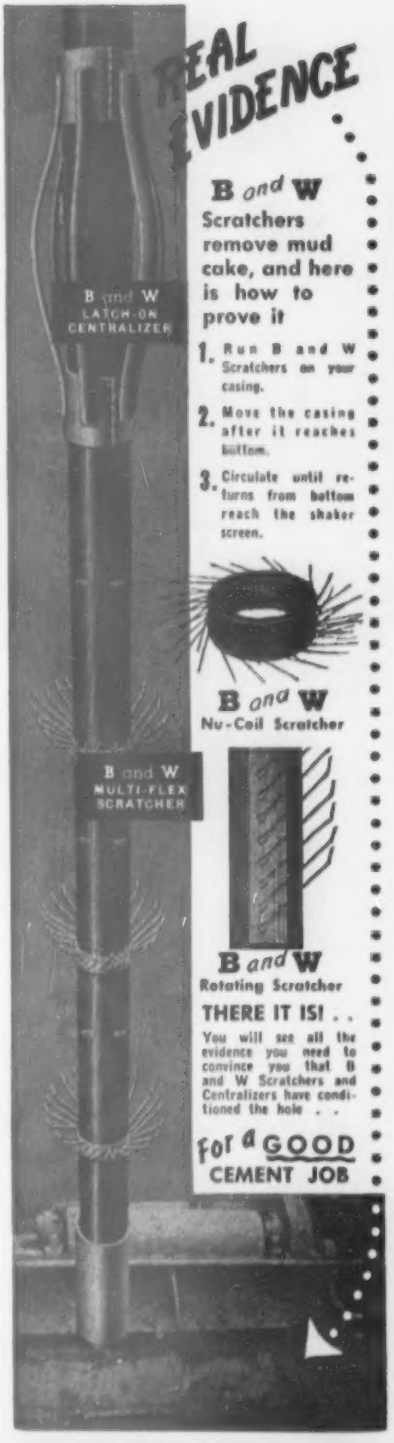
Bethlehem Supply Co. has announced the appointments of tubular sales managers for the Northern, Central, and Gulf Coast divisions. W. F. Taylor has been appointed tubular sales manager for the Northern division and will continue to headquarter at Tulsa. E. R. Phillips has been promoted to tubular sales manager for the Central division and will headquarter at the Dallas sales office. L. A. Myers has been named tubular sales manager for the Gulf Coast division and will headquarter at the Houston division office. F. C. Beattie has been promoted to special representative for the Oklahoma district and will specialize in the sale of all production equipment, including pumping units, sucker rods, bottom hole pumps, etc. U. C. Blankenship has been advanced to store manager and field representative at the Oklahoma City store. H. M. Braymer has been appointed machinery sales representative for the West Texas-New Mexico district and will headquarter at the Odessa, Tex., store; D. G. Collins has been assigned as store manager and field representative at the Grayville, Ill., store; and H. A. Sumrell, Jr., has been employed recently as local representative for the Ark-La-Tex district and will headquarter at the Shreveport, La., district office.

E. R. PHILLIPS

L. A. MYERS

In order to maintain better sales and service coverage under the new merchandising policy of oil-country tubular goods, Bethlehem Supply is establishing in-transit tubular stocks at selected barge points along the Mississippi River and the Gulf Coast. This practice will enable Bethlehem to be competitive, carry flexible inventories, and expedite deliveries of all sizes and grades of casing and tubing. Stocks are being built up at West Memphis, Ark.; Vidalia, La.; Houston and Kansas City.

Taylor has been with Bethlehem


REAL EVIDENCE
B and W Scratchers remove mud cake, and here is how to prove it
1. Run B and W Scratchers on your casing.
2. Move the casing after it reaches bottom.
3. Circulate until returns from bottom reach the shaker screen.
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B and W Nu-Coil Scratcher
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THERE IT IS! . .
You will see all the evidence you need to convince you that B and W Scratchers and Centralizers have conditioned the hole . .
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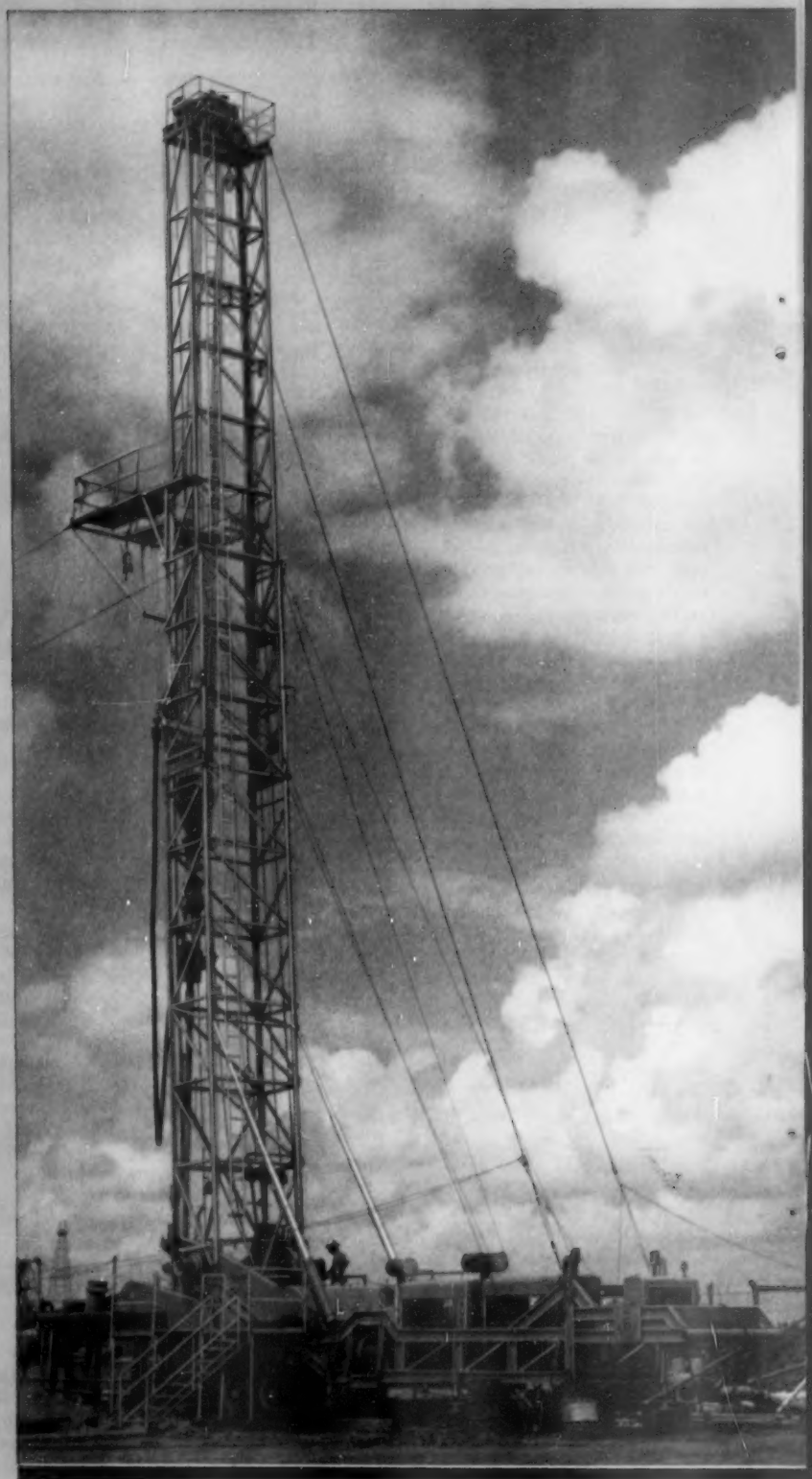
Designed for highway moving, yet all full-size drilling rigs.

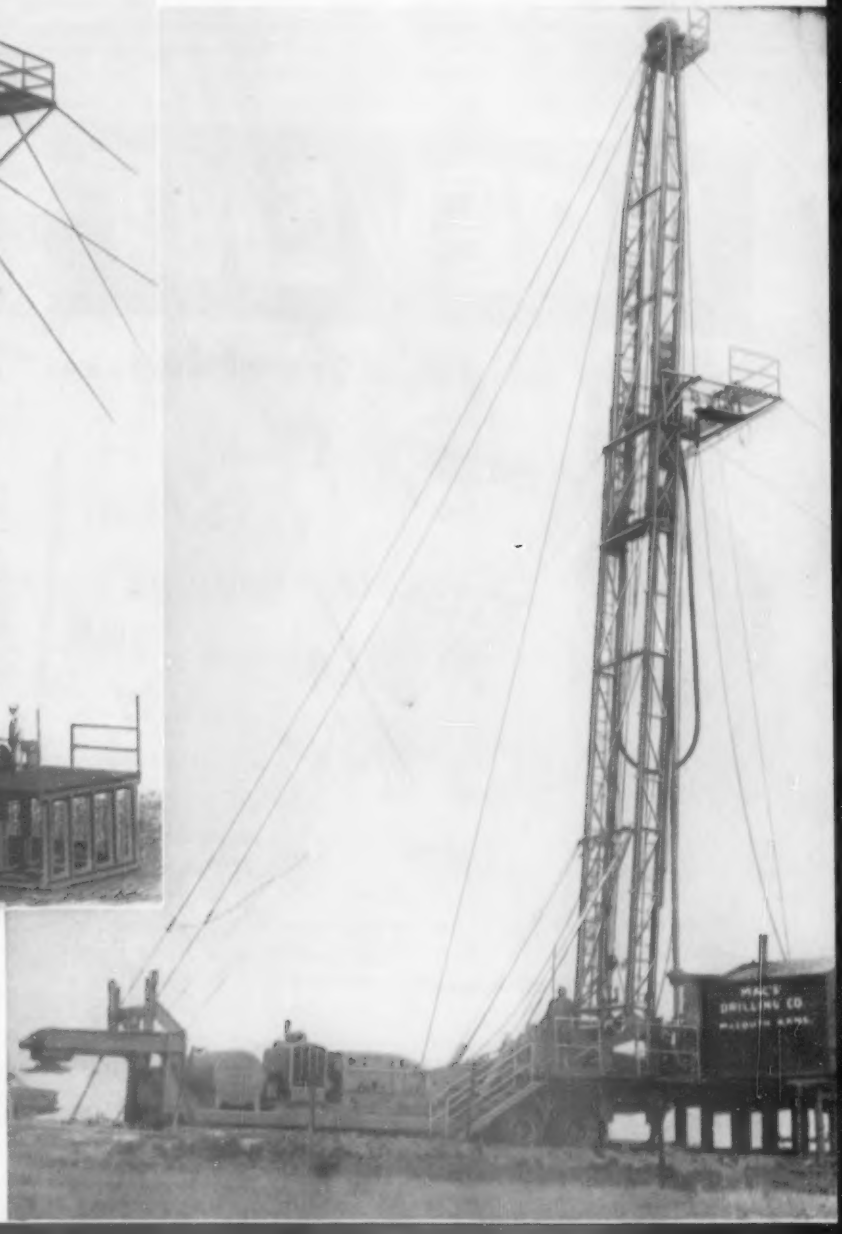
QUICK RIG-UP
Can be spotted and mast raised in minutes—complete rig-up in 3 to 4 hours.

LOW IN COST
Compare the initial cost with any rig and you'll find more rig per dollar. Check your slim hole drilling rig requirements with CARDWELL. You'll be miles ahead in footage and thousands of dollars in profits.



CARDWELL "TRAILERIG" is best for 10,000-ft. slim hole drilling. Ninety- or 96-foot mast and twin-engine draw works are built into the trailer frame, making a complete, utilized rig.

CARDWELL 152 "TRAILERMAST" with 84-ft., 150,000-lb. capacity mast provides the maximum in movability and rig-up speed. Model AH or Model L single engine draw works can be mounted on trailer frame. Built-in hydraulic system erects mast.



CARDWELL 151 "TRAILERMAST" can be used with Model L, Super S, or Model D draw works, and is moved complete with lines and block reeved up. Ninety-six-foot mast with 150,000 lbs. capacity is raised by draw works mounted on trailer frame.

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since 1936 and was chief clerk in the tubular sales department for a number of years prior to 1949 when he was made manager of refinery sales. Taylor will be under the direct supervision of V. W. Bailey, Northern division manager. Phillips has been with Bethlehem since 1947, and most recently was store manager and field representative at the Grayville store. Phillips will be under the direct supervision of C. C. Crider, Central division manager. Myers has been employed by Bethlehem since 1945. Most recently he has been a special representative working out of the Tulsa office, covering major customer accounts in the Mid-Continent area. Myers will be under the direct supervision of J. V. Spalding, Gulf Coast division manager. Beattie, formerly store manager and field representative at Oklahoma City, has been with Bethlehem for 10 years. Blankenship was formerly assistant store manager under F. C. Beattie, whom he is replacing. Braymer, previously a machinery sales trainee at Tulsa, will be under the supervision of Art Weber, manager of the West Texas-New Mexico district. Collins was formerly assistant store manager at Grayville. Sumrell will be under the supervision of J. G. Floyd, manager of the Ark-La-Tex district.

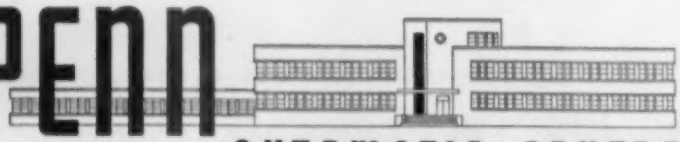
PREVENT

costly engine troubles...

Catch 'em "young" with a PENN Safety Control

At the first sign of overheated cooling water or lube oil pressure failure, your Penn Safety Control sounds an alarm, flashes a warning light, or rings a bell — whichever you prefer. In this way you spot little troubles — before they get a chance to grow big and expensive. It's mighty low-cost insurance against costly downtime and whopping repair bills. Let us send you the complete story — write **Penn Controls, Inc., Goshen, Indiana.**

PENN



AUTOMATIC CONTROLS

FOR HEATING, REFRIGERATION, AIR CONDITIONING, GAS APPLIANCES, PUMPS, AIR COMPRESSORS, ENGINES

American Cyanamid Shifts Ben H. Loper to Houston

Ben H. Loper, technical representative of the refinery chemicals department of American Cyanamid Co., has been transferred to Houston. Loper will cover the territories handled by the firm's Houston, Tulsa, and Los Angeles sales offices.

Loper joined Cyanamid in 1950 at the research laboratories in Stamford, Conn. A few months later he was transferred to the Fort Worth, Tex., plant where fluid-cracking catalysts are produced. He went to the Michigan City, Ind., plant in 1951 when that plant began production of cracking catalysts. He was appointed plant engineer in 1952. Loper became a technical representative for the refinery chemicals department in New York in 1953, and remained there until his recent transfer.

Dowell Promoted Millar to General Office Position

P. J. (Pete) Millar, Dowell Incorporated, has been promoted and transferred to the company's general offices in Tulsa according to R. H. Smith, director of sales.

Millar joined Dowell in 1948 at Kermit, Tex., as service engineer. He was promoted to station manager in 1949 and in 1950 became sales engineer. In 1952 he became area sales engineer with headquarters at Odessa, Tex. He has been district sales engineer for the past year.

Southern Engine & Pump Opens Beaumont Branch

Southern Engine & Pump Co. has announced the opening of its eighth branch office, located at Beaumont, Tex. S. J. (Jim) Jamison, Jr., has been appointed as manager of the new office which will provide more convenient pump and power-supply service to industry and individuals in the Beaumont area.

Jamison has had varied experience in equipment sales and engineering and recently furnished specialized training at Southern Engine & Pump's Houston headquarters.

According to Jamison the Beaumont

Kennametal* Balls and Seats outlast best alloys 26 to 1 ...still in service in problem well pump

Strongly corrosive cuts from this Ventura Avenue field destroyed the effectiveness of the best alloy steel balls and seats in a maximum of three weeks' service.

A year and a half ago, the operator installed Kennametal top and bottom valving to meet these conditions. During this period, he has surfaced the pump every four months because of plunger wear, but has not found it necessary to replace the Kennametal Balls and Seats. Already they have outlasted the best alloy steels 26 to 1, and they're still in service.

Performance reports such as these are not unusual. Kennametal Balls and Seats are reducing the costs of string pulls, maintenance and loss of production wherever they are used. If you have a problem well, ask your pump service man to install Kennametal valving. It will cost you less in the long run.

Kennametal lightweight (titanium-carbide) balls have proven themselves in wide usage throughout the oil industry. They are one-third lighter than steel and about one-half lighter than tungsten-carbide. Outstanding results have been obtained in applications where there is excessive leaching in fluids containing hydrogen sulfide cuts, in pumps that pound for fluid and in slant pumping where there is excessive cage wear. Their resistance to wear, corrosion and electrolytic action represents an advance over any other type of ball as a utility unit. KENNAMETAL INC., Latrobe, Pa.

**Kennametal is the registered trademark of a series of hard carbide alloys of tungsten, tungsten-titanium and tantalum.*

INDUSTRY AND
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5501

office will feature complete engineering service, replacement parts, and a service department, along with the sale of Le Roi engines, Fairbanks-Morse equipment, Pomona pumps, Viking pumps, Goulds pumps, and Marlow pumps.

Universal-Matthey Starts British Catalyst Plant

The new catalyst manufacturing plant of Universal-Matthey Products, Ltd., began operations early in November, just a little more than a year after ground was broken.

The plant, located on a 10-acre site near London, will manufacture and make available in the sterling market U.O.P. platforming catalyst for use by refineries in producing premium-quality gasoline. The company already has entered into contracts to supply the catalyst to customers in England, Germany, France, Australia, and Aden.

Opening of the plant, which was built by Procon (Great Britain) Ltd., marks the first time that platforming catalyst has been manufactured outside of the United States.

Universal-Matthey is a subsidiary of Universal Oil Products Co., Des Plaines, Ill., developers of the U.O.P. platforming process, and Johnson, Matthey & Co., Ltd., London platinum refiners.

ANGLO-IRANIAN OIL COMPANY,-LIMITED

NAME CHANGED TO

THE BRITISH PETROLEUM COMPANY LIMITED

CAPITAL INCREASE AND SCRIP ISSUE APPROVED

At an Extraordinary General Meeting of the Anglo-Iranian Oil Company, Limited held on 16th December in London, England, the proposed increase of capital and scrip issue, and the change of the Company's name to The British Petroleum Company Limited were unanimously approved.

Sir William Fraser, C.B.E., LL.D. (the Chairman), before putting the proposals to the Meeting, in the course of his speech said:

"First of all, certain adjustments will have to be made in the balance sheet as at 31st December, 1954, of the parent Company, and also in the consolidated balance sheet, arising from the settlement made in connection with our interests in Iran. The main differences on the Liabilities side will be the disappearance of the Special Contingencies Account; there will also be adjustments in Provision for Taxation. On the Assets side we shall be eliminating all those relating to our former interests in Iran. It is anticipated that all necessary adjustments can be effected without drawing on General Reserve Account.

As described in the statement posted to Stockholders on 30th October, the Company is to receive, over a period of years, a net payment of £25,000,000 from the Iranian Government and, related to production, approximately £214,000,000 (at the current dollar exchange rate) from the other Companies participating in the Consortium as a result of the agreements recently concluded. It is intended that these sums should be utilised for the further development of our business and it is reasonable to expect that they together with depreciation provision, should go far towards meeting our future capital requirements.

Unusual circumstances from 1946 onwards

It may be recalled that from 1946 onwards I have frequently stated that but for unusual circumstances larger dividends on the Ordinary Stock would have been warranted.

For the whole period from 1947 to 1953 £107,500,000 were allocated to General Reserve and £6,000,000 to Preference Stock Reserve, a total of £113,500,000, while during the same period the distribution to Ordinary Stockholders totalled £24,750,000. Total capital expenditure during the same period was over £340,000,000, largely financed from depreciation provision and amounts placed to reserve.

Future Dividends

In 1953 our capital expenditure amounted to £75,000,000 and in the current year is about £55,000,000: the principal capital projects now in hand should shortly be completed and during next year and for some time capital expenditure will, I expect, be on a smaller scale. It should therefore be possible in future to distribute as dividends a larger proportion of the profits available. I would remind Stockholders that our profits depend on conditions prevailing throughout the entire industry and that the oil industry is liable to severe fluctuations from time to time.

It is your Board's intention in future to make any interim dividend payment larger in relation to the expected total annual payment than has been the case in the exceptional circumstances of recent years.

I will only add that our profit margins this year are less than last, but with the increased quantity of our sales I expect that our earnings for 1954 will not greatly differ from those of 1953.

The Company's New Name

The new name proposed for the Company conforms with its overall operations and changed position in the Iranian Oil industry. The Company's main trade mark remains BP, as first adopted in 1921 and of recent years incorporated in the titles of most of our subsidiary and associated marketing companies.

Proposing a vote of thanks to the Chairman, Board, and Staff, Sir Arthur Evans said: Had it not been for the patience exercised by the Board and the guidance given by the Chairman, I do not think we should have been meeting thus today. We wish to thank the Chairman, Board, and Staff at home and overseas for splendid teamwork in unparalleled times.

Chance Made President Of Engineering Firm

H. M. CHANCE

Henry M. Chance, II, has been elected president of United Engineers & Constructors, Inc., according to an announcement issued by the board of directors. United Engineers & Constructors is a nationally known engineering and construction firm in the utility, industrial and chemical fields.

Chance has been associated with the company for the past 18 years. Starting as a design engineer, he later became an assistant construction manager. In 1946 he was named assistant to the president and in 1949 was elected vice president and a director. In this capacity he was responsible for the executive management of the engineering and construction functions of the corporation.

Hammond and Sears Plan Tentative Reorganization

A tentative agreement has been made by Hammond Iron Works of Warren, Pa., and Henry Sears & Co. of New York to form a new company as yet unnamed which will carry on and expand the present business, products, and facilities of Hammond Iron Works.

The new company will be built around the present Hammond personnel, organization, and facilities and will be augmented to provide greater service to general industry, particularly in the petrochemical, processing, and utilities fields.

Hammond Iron Works was organized in 1900 and has been in business continuously since that year. It now has plants in Warren and Bristol, Pa., Birmingham, Ala., Provo, Utah, and Casper, Wyo.

Graver Water Conditioning Opens Texas District Office

H. T. Sulcer, vice president and general manager of Graver Water Conditioning Co. has announced the opening of a new Texas district office at Houston. This Graver district office will be managed by James J. Hanratty and will serve all of New Mexico and Texas except the northern part of the Panhandle.

Hanratty has been with Graver for many years and is very well versed in all phases of industrial-water and waste treatment.

Oil Center Tool Uses Plane to Service Customers

To provide fast contact with customers who need service in a hurry, Oil Center Tool Co. has added an airplane to its headquarters facilities in Houston. The plane, an Aero Commander, will serve O.C.T. customers whatever their location, John Maher, president of O.C.T. stated. Pictured by the plane are Fritz Richards, left, veteran O.C.T. salesman, and Pilot Clark Hewitt.

Pipe Line Anode Names Ragland Chief Engineer

Pipe Line Anode Corp. has announced the appointment of Thomas M. Ragland as chief engineer of the company. Ragland has been associated with Phillips Petroleum Co. during the past 4 years as a corrosion engineer.

Ragland announced the change will not effect his appointment as 1955 chairman of the corrosion short course for pipeliners that is being sponsored by the Tulsa section of N.A.C.E., February 16, 17, and 18.

The addition of Ragland furthers the surveying, engineering, and installation services offered by Pipe Line Anode.

Maintenance Engineering Names Two Sales Engineers

The employments of Warren B. Hermes as sales engineer and Marion G. Johnson as sales engineer in the metering and control-equipment section have recently been announced by C. E. Naylor, president of Maintenance Engineering Corp.

Hermes has been with Brown & Root, Inc., for 4 years, having worked for them in instrumentation, drafting, and field-instrument engineering. With Maintenance Engineering he will devote his time to the Masoneilan & Smith Meter Sales Davision.

Johnson has had 6 years' experience as sales service engineer with Bailey Meter Co. in the Houston branch office. Prior to his work with Bailey, he was with Aluminum Co. of America in the New Kensington, Pa., plant.

McCullough Tool Opens Rio Vista Service Branch

K. A. SUMMERS

The opening of a new McCullough service location at Rio Vista, Calif., in the Pacific division has been announced by I. J. McCullough, president of McCullough Tool Co. The new branch office is fully equipped to supply the oil industry with McCullough perforating, logging, and fishing-tool services.

The new branch will be under the supervision of K. A. (Kenny) Summers, a veteran McCullough employe in the California oil fields. Summers has been with McCullough for over 10 years. He has had extensive experience in all phases of McCullough's operations, his last position having been fishing-tool supervisor at the Los Angeles service office.

McCullough now has 5 service-branch locations in California and a total of 51 offices in the United States and Canada.

INSULATION MAINTENANCE

★ ★ ★ ★ ★

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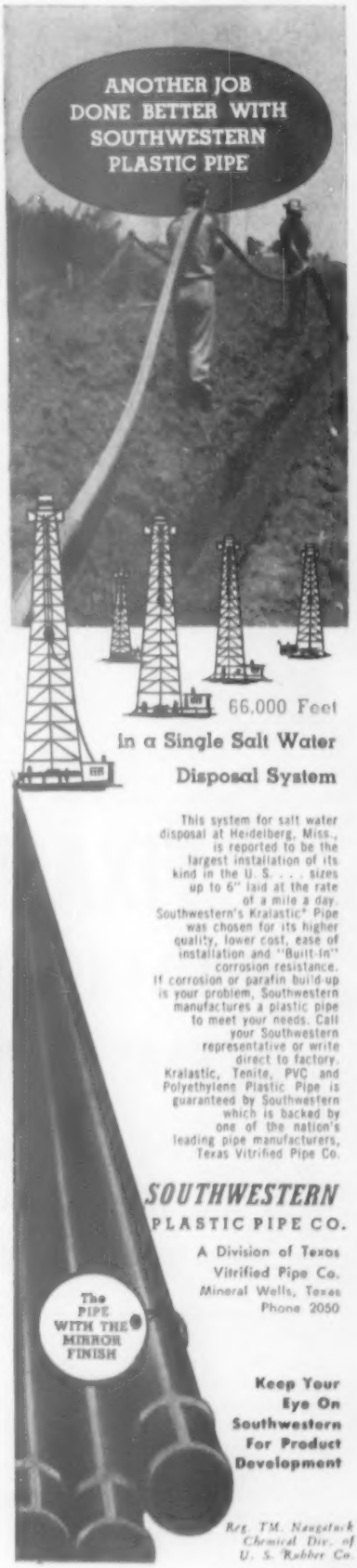
ANOTHER JOB DONE BETTER WITH SOUTHWESTERN PLASTIC PIPE
66,000 Feet
In a Single Salt Water
Disposal System
This system for salt water disposal at Heidelberg, Miss., is reported to be the largest installation of its kind in the U. S. . . . sizes up to 6" laid at the rate of a mile a day. Southwestern's Kralastic* Pipe was chosen for its higher quality, lower cost, ease of installation and "Built-In" corrosion resistance. If corrosion or parafin build-up is your problem, Southwestern manufactures a plastic pipe to meet your needs. Call your Southwestern representative or write direct to factory. Kralastic, Tenite, PVC and Polyethylene Plastic Pipe is guaranteed by Southwestern which is backed by one of the nation's leading pipe manufacturers, Texas Vitrified Pipe Co.
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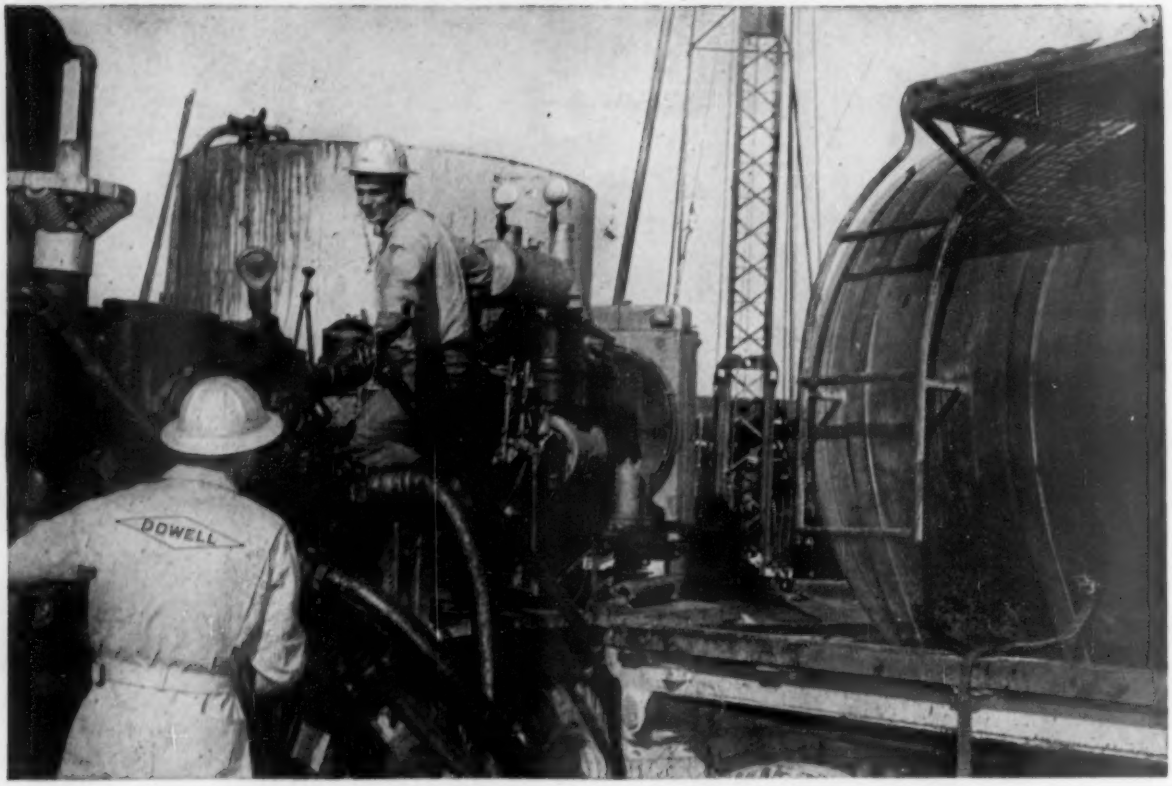


FIXAFRAC

AIDED FRACTURING TO INCREASE PRODUCTION

DOWELL Temporary Plug sealed permeable zone permitting successful retreatment

Fixafrac*—a temporary plugging service performed by Dowell—may provide the means of successful retreatment where initial fracturing or acidizing has been unproductive. Dowell uses Fixafrac material to divert the treating fluids into different sections of the pay by sealing off unproductive, depleted or previously treated zones. The material used carries suspended solids which react after a short time causing the Fixafrac to liquefy and flow back freely to the well bore.

Here's a case where a new well failed to produce oil in commercial quantities. A fracturing treatment by another service company got no results. Dowell engineers, called on the job, recommended Fixafrac followed by a Stratafrac* treatment. After this service, the well flowed 13 barrels of oil per hour, according to production tallies.

This is only one of the many cases where Dowell Service has paid dividends to the operator. You, too, may profit from Dowell's long experience, expert know-how and specially designed, heavy-duty equipment. For further information, call the nearest Dowell office or write DOWELL INCORPORATED, Tulsa 1, Oklahoma, Dept. A-11.

*A service mark of Dowell Incorporated.

services for the oil industry

DOWELL

A SERVICE SUBSIDIARY OF THE DOW CHEMICAL COMPANY

EXPLORATION

Oklahoma Embarks on Year of Promise

by John C. McCaslin

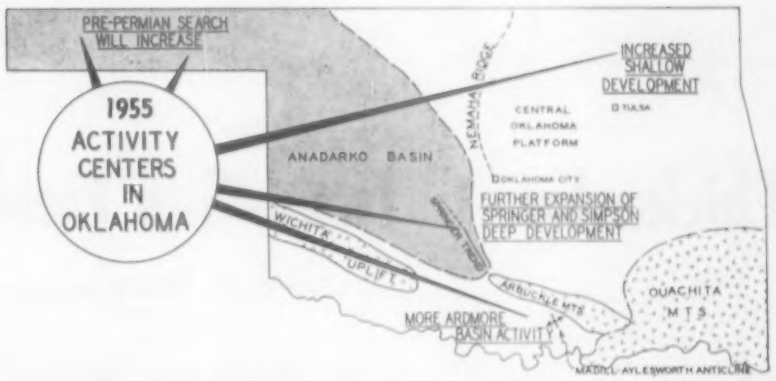
WITH its best exploratory and development year in history behind it, Oklahoma is entering a new era of promise. The record books still sag with the phenomenal number of completions and footage piled up in 1954. The industry completed 8,786 wells last year, 859 of them exploratory tests. Wildcatters opened up 156 new oil areas and 25 new gas pools.

Four big developments went to the front of the class in 1954, (1) the Panhandle pre-Permian development, (2) the increase in shallow drilling in northeastern Oklahoma, (3) the deep Simpson and Springer play in the Grady-Garvin County area, and (4) the most significant discovery of all—the multipay strike on the Madill-Aylesworth anticline (Sinclair Oil & Gas Co. et al 1 Griffin). This year's big stories will come from these same areas of Oklahoma.

Sinclair will offset the new Marshall County discovery at 1 Nunley, C NW NW 15-5s-5e. The new test will aim for the multipay zone found in the discovery well. The 1 Griffin found nine other pays in addition to the basal McLish. They ranged from the Springer-Pennsylvanian to the Oil Creek sand of Ordovician age.

Important pool looms . . . Easily the most important discovery news last year was the Sinclair discovery in Marshall County, southern Oklahoma.

The 1 Griffin, 2 miles north of Madill, was completed flowing 810 bbl. of oil in 14 hours, natural, from the basal McLish (Simpson-Ordovician). The wildcat gave the geologically mixed-up Ardmore basin just what it needed in the way of encouragement for expanded exploration. Here the cost of drilling and exploration has kept activity down to a snail's pace in recent years. The basin has not been attractive to the independent, and the majors have been leary of plunging into the area. The excellent success of the Griffin well, one of the most closely watched tests in Oklahoma in years, plus a new Simpson pool near Ardmore in 1954, give real promise to this complex basin for the future. The 1 Griffin discovery has good indications of becoming another Cumberland or Apache field.



Four areas in Oklahoma show great exploratory and development promise for 1955. These four, the Panhandle, Ardmore basin, the shallow northeastern area, and the Springer trend, all figured highly in last year's exploratory race.

Springer bonanza . . . Out in Grady and Garvin counties, the fast-growing Springer play is taking on the proportions of a real West Texas Ellenburger play.

Development in this area, which began in earnest in 1952, just made a small dent in 1954. The current year will see even bigger developments along the northwest-trending sand play. Coupled in importance with the Springer boom is a highly successful Ordovician program in the Bradley area of Grady County. Here Oklahoma's deepest oil production was established last year. The great depths and ensuing drilling costs are the only factors confronting the drillers in the Springer and Ordovician development. But, from all indications these problems will not retard a rapid development of this trend. The latest addition to the chain of Springer pools is Sinclair's 1 McClintock in Grady County. This well, which moved the play about 2½ miles northwest, was completed for a flow of 313 bbl. of oil in 24 hours from deep perforations at 11,717-85 ft.

Panhandle will be busy . . . In 1955 Texas County pre-Permian development will continue a quiet, but fast expansion, while Beaver County will blow its horn with a big comeback. Several gas-condensate strikes late last year plus a carryover of five indicated discoveries into 1955 give support to a predicted busy year for Beaver County. Big potentials and excellent success in the pre-Permian areas of Texas County, linking Hugoton field on both sides, indicate that Eva and Camrick oil and gas fields may well become major Hugoton embayment producing areas this year, rivaled only by southwestern Kansas' big Greenwood field.

The most recent boost to the 1955 prospects for the Camrick area is a 3¼-mile northwest extension which was shut in last week as a major gas well. Kansas-Nebraska Natural Gas Co. 1 Brown, NW NW SE 25-2n-18eCM, flowed 8,768 M.c.f. of gas per day natural from Morrow perforations at 6,442-6,521 ft. This new success is located almost on the very edge of Hugoton field gas production. It is separated from Grand Valley field, 6 miles to the east.

The Topeka and Lansing limes of Pennsylvanian age will play a big part in the Oklahoma Panhandle pre-Permian search in 1955. Two wildcats in the Camrick area have shown for production from the two zones in the past 2 weeks.

More shallow-play news . . . After a period of slow, unheralded development work, northeastern Oklahoma shot back into the records in 1954 with even better things promised for this year. Old producing areas in Osage, Washington, Nowata, and Rogers counties reported an impressive list of new wells and extensions last year. Creek County finished more wells than in the past 2 years combined.

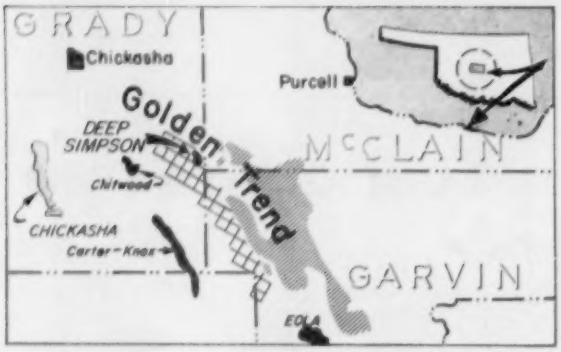


Fig. 1

Today's aggressive play in Chickasha is largely the result of one man's efforts—those of the author, "Polly" Wallace. By using the well data compiled by many operators in developing the field's gas-producing sands, and by painstakingly mapping the Permian stratigraphy, he instigated the play that has resulted in more than 100 producing oil wells. Here's his description of . . .

Chickasha: A Tired Gas Field Yields Oil

by P. A. Wallace

OIL production from shallow Permian sands at 3,000-3,500 ft. has touched off an aggressive drilling campaign in the old Chickasha gas field, first discovered in 1922.

These zones were originally passed up during the early drilling of the field.

More than 100 wells have been completed in these sands since production was established in March 1954. On December 1, 1954, there were 58 active locations covering an area 15 miles long and 3½ miles wide.

It is difficult to forecast the ultimate outline of the new reservoir. Recent wells down the east flank of the structure seem to show a better development of sands in the upper part of the zone where the lower sands carry water. Some wells have found oil in the Fortuna (Permian) series on the east flank. Few wells have been drilled on the west flank of the structure, but it is entirely possible that conditions on the west will be similar to those on the east flank and that the producing area may be broader than the area of the original gas production.

Early development . . . Chickasha gas field is located in Townships 4 and 5n, Range 8w, in southwestern Grady County, Oklahoma. The field is some 10 miles long and 2 miles wide, extending from near the center of Township 5n to the southeast corner of 4n-8w.

The discovery well was completed by John B. Nichols in July 1922 in the northeast quarter of Section 26-5n-8w. Gas was found in the Garber (Permian) sand at a depth of 1,350 ft. In March 1923, W. R. Ramsey completed a well in the southwest quarter of Section 23-5n-8w in the Fortuna (Permian) sand series, between the depths of 2,029 and 2,500 ft. The next important development was the well drilled by Carter Oil Co. in the southwest quarter of Section 26-5n-8w. After drilling to a depth of 6,620 ft., the well was completed in April 1939 for a gas well in a series of Deese (Pennsylvanian) sands from 5,330 to 5,520 ft.

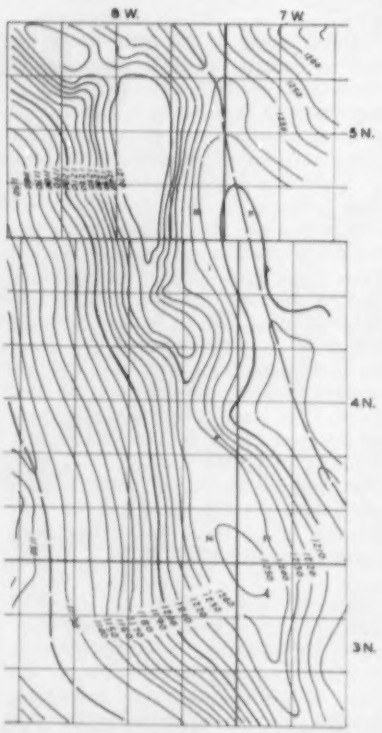


FIG. 2—This original surface map prepared by the late Clyde M. Becker was used during preliminary work in developing the Permian sands.

Structure . . . The Chickasha structure is in the Anadarko basin. In the Pennsylvanian, it is a long, relatively narrow, steeply dipping anticline which plunges to the south. It is faulted along the east side by a major fault. At the north end a fault extends northwestward. The Pontotoc was deposited on the eroded surface of the Pennsylvanian beds; the Pontotoc terrane is both Pennsylvanian and Permian in age. The later Permian was, probably after a hiatus, deposited over the irregular surface.

Permian sands. . . . A rather unusual feature in the development of the Chickasha gas field was the failure to exploit the series of Lower Permian sands between the Fortuna series and the Pennsylvanian sands. This may perhaps be explained by the rapid rate of drilling and the unattractive appearance of the sands in well cuttings. Numerous shows of oil and gas were reported and several drill-stem tests were taken, but only two wells were completed in this series of sands. One well in the southwest quarter of Section 23-5n-8w, and one well in the southeast corner of Section 11-4n-8w were completed for small oilers.

In March 1954, General Drilling Co. completed its 1 Farwell A in the SW NW SE of Section 26-5n-8w in a sand between the depths of 3,095 and 3,120 ft. after drilling to the total depth of 3,237 ft. General Drilling Co. started immediately on the second well, 1

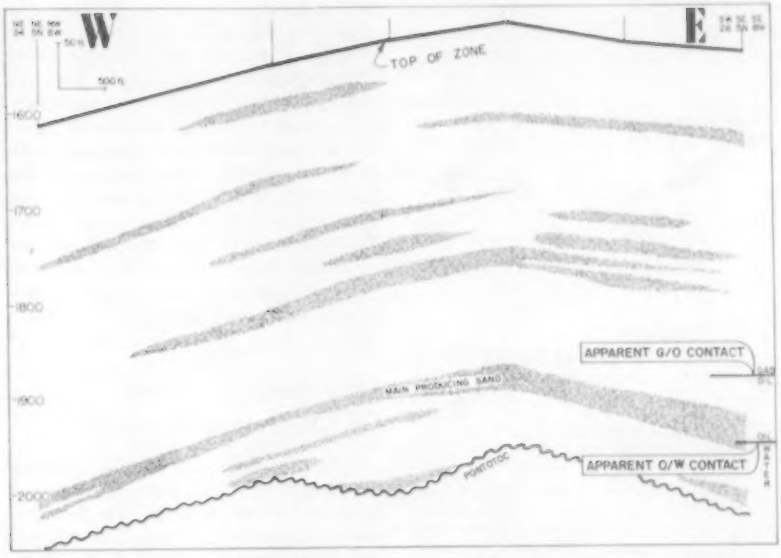


FIG. 3—Erratic nature of the producing sands is shown in the above cross section. Production is controlled by both stratigraphy and structure.

Smith A, in the southwest corner of Section 26, but it was not until this operator was completing the third well that any great interest was shown by other operators. The first important extension was drilled by Atmar in the northeast quarter of Section 11-4n-8w, about 2½ miles south of the discovery well. After drilling to the total depth of 3,495 ft., the well was completed in May, in a sand from 3,050-70 ft. In July 1954, Woodward & Co. drilled a well 8 miles south of the discovery in the northwest corner of Section 6-3n-7w. Drilled to the total depth of 5,625 ft., the well was completed in two sands—3,308 to 3,320 and 3,494 to 3,506 ft. Activity was really stimulated in the area by this last extension.

Considering the widespread activity, the percentage of dry holes is low.

Completion methods . . . Average depth of the wells is 3,500 ft.; spacing pattern has been set by the Corporation Commission at 20 acres; and the average drilling time, which generally includes some drill-stem tests, is 10 days. Average cost to drill, complete, and equip a well is $10 per ft. Gravity of the oil is 26° to 28°.

Standard procedure for completing wells has been to set 5½-in. casing through the lowest-possible producing sand, to perforate the casing in the sands, and to give a sand-oil treatment. Initial potentials, after this method of completion, tend to be higher. And, since the allowable at present is 15 bbl. per day, it will take some time before we know the true potentials. A few wells have been completed without the sand-oil treatment and have made the allowable. Most of the wells are flowing. The few pumps installed are for agitation rather than actual pumping.

Producing zone . . . The producing zone is a series of very lenticular sands of lower Permian age some 400 ft. in thickness. The zone is defined by a persistent shale break at the top and at the base by the top of the Pontotoc. The most persistent sand is the basal sand. It is generally 100 ft. or less above the top of the Pontotoc.

The sands, as a rule, are fine grained, shaly, and calcareous. There are limestone nodules associated in the shales and also in the sands, particularly near the edges of the sand lenses. Where the sands are well developed, the porosity is 18 to 26 per cent. The permeability is extremely variable and in a single core had a range from 48 to 564 millidarcies.

The trap for oil or gas is in part structural and in part stratigraphic. In 5n, where the main producing sand is near the base of the zone, it appears to be a blanket sand and seems to have a rather definite gas-oil and oil-water contact. In 4n-8w where the sand is more lenticular, gas wells have been made, apparently, from the same sand as oil wells farther updip.

The zone has been called the Noble-Olson zone, but it is believed this name is not appropriate in the Chickasha gas field. The name has been carried from Cement where the zone is only some 100 ft. in thickness, while at Chickasha the zone is 400 ft. or more. Some companies say the only Noble-Olson sand is the basal sand in the zone, the others are Fortuna. The zone is definitely separate from the Fortuna sand series because the reservoir characteristics are different. On structure, the Fortuna sands carry gas. Below the gas sands is a series of water sands. Still deeper, the sands of this zone carry oil or gas, but are predominantly oil.

It is believed that after flush production the wells will level off at about 50 bbl. per day. It is reasonable to expect good ultimate recoveries. The old well in the southeast corner of Section 11-4n-8w, completed in 1939, has produced more than 60,000 bbl. of oil from 13 ft. of sand, and is still producing. In the recent development, this old well has had two direct and one diagonal offset and they are all producing wells.

At the time of the development of the Chickasha gas field, the late Clyde M. Becker was active in the area. The writer had access to his work and maps and found them invaluable in his preliminary work. Fig. 2 is a copy of Becker's surface work covering the field. The map was used as a guide both for the location of the discovery well of the General Drilling Co. in 26-5n-8w and for the discovery well of Woodward & Co. in the northwest corner of 6-3n-7w.

Fig. 3 is a west-east cross-section from the NE NE NW of Section 34-5n-8w to the SW SE SE of Section 26-5n-8w. It shows the zone and the lenticular nature of the sands in the zone.

ABOUT THE AUTHOR

P. A. WALLACE

P. A. (Polly) Wallace is a consulting geologist in Oklahoma City. He received his A.B. and M.S. in geology at Oklahoma University where he was an All-American center during the 1926-27 season. He worked for Amerada Petroleum Co. from 1935 to 1944 doing stratigraphic and research problems. Prior to entering consulting work in 1949, he was chief geologist for Stephens Petroleum Co. He is a member of the American Association of Petroleum Geologists and the Oklahoma City Geological Society.

"It is believed that after flush production the wells will level off at about 50 bbl. per day. It is reasonable to expect good ultimate recoveries."

Exploration Highlights

MID-CONTINENT

OKLAHOMA

New Cleveland County Area Has Been Expanded

The first offset to an indicated Wilcox sand oil discovery in Cleveland County, south-central Oklahoma, has been staked by Herman Brown. The 1 Briggs-Hames, NW SE SW 21-9n-1w, is a southeast offset to the 1 Perkins-Todd, SE SW NW 21, which has indicated successful production from the Wilcox sand.

Layton Production Being Tested At Lincoln Wildcat

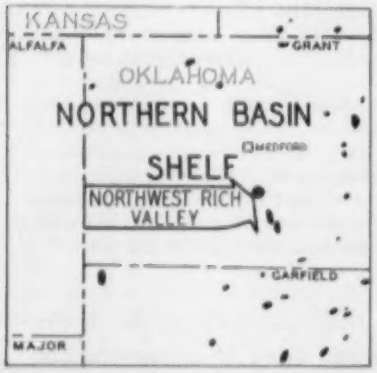
An outpost well to West Perkins and Oliver fields in Lincoln County, central Oklahoma, is being tested by The Texas Co. at 1 Stumbo, SW SW NW 22-17n-2e.

The well was treated at 3,288-92 ft. to flow 59 bbl. of load oil, 123 bbl. of new oil and 200 bbl. water in 18 hours through open tubing. On swab the flow made 52 bbl. of oil and 265 bbl. of water. The Layton pay is new for the area.

Northwest Rich Valley Has Second Well Indicated

The second well for Northwest Rich Valley pool in Grant County on the Northern Basin Shelf is taking production tests.

Carter Oil Co. et al 1 Schuermann, C SW SW 14-30n-5w, flowed 119 bbl. of 43.8°-gravity oil in 2 hours on a drill-stem test in the Marshall sand at 5,814-25 ft. Recovery was 990 ft. of oil.



Second producer indicated for Northwest Rich Valley field in Grant County.

Expansion is due at Love County's new Greenville field. In Marshall County Sinclair Oil & Gas Co. has announced offset work for the new multipay discovery north of Madill, which was Oklahoma's exploratory highlight of 1954.

Extension Planned for New Greenville Field

Love County's new Greenville field in extreme southern Oklahoma, will have expansion work.

Schermerhorn Oil Corp. will go to 4,200 ft. at 1 Peery, SW SW SW 21-6s-2e.

The discovery well was A. D. Britton 1 Vestal, NW NW NW 28-6s-2e. This well made a flow potential of 185 bbl. of oil daily through a small choke from 4,034-46 ft. in the Dornick Hills of Lower Pennsylvanian age.

Tillman County's Northwest Trimue Field Extended

Northwest Trimue field in Tillman County, southwestern Oklahoma, has been extended southeast by Sunray Oil Corp.

The 2 Copeland-Ray, NW SE SE 3-3s-19w, flowed 167 bbl. of oil per day on ¼-in. choke from open hole at 5,074-90 ft. in the Strawn conglomerate on initial production test. Sunray has staked location for the 3 Copeland-Ray in SE SE SE 3.

The field was opened last year at S. D. Johnson 1 Maguire, SW SW NE 3. Johnson's interest and leases were bought by G. E. Kadane & Sons who are continuing the field development.

Offset Due By Sinclair At Marshall Discovery

Sinclair Oil & Gas Co. will offset the recently-opened multipay pool north of Madill in Marshall County, southern Oklahoma. The new well will be the 1 Nunley, C NW NW 15-5s-5e. The new test will aim for the multizone pay found in the Sinclair et al 1 Griffin, SE NE NE 16-5s-5e.

The 1 Griffin, undoubtedly the most significant 1954 discovery in Oklahoma, was completed early in January for 810 bbl. of oil in 14 hours through ¾-in. choke from perforations in the basal McLish at 6,587 to 6,635 ft. The well also got 195 bbl. of load water. The discovery found nine other pay zones in addition to the basal McLish. They ranged from the Springer-Penn to the Oil Creek sand of Ordovician age.

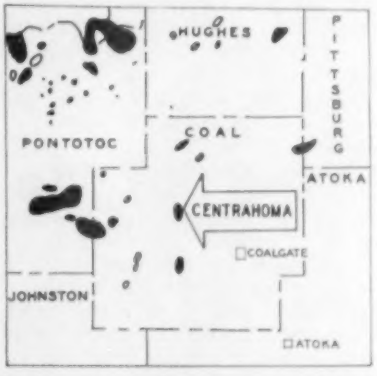
New Geologic Map Of Oklahoma Released

A new geologic map of Oklahoma is the result of more than 7 years of concentrated work aided by the generous cooperation of the oil companies and independent geologists of Oklahoma and of all official agencies, institutions, and persons who are concerned with Oklahoma geology. The new map replaces the first geologic map of the state published in 1926, which was also prepared under Hugh D. Miser's direction. More than 80 per cent of the state is covered on the new map.

"Geologic Map of Oklahoma"

The new map is printed on the recently published Oklahoma base map on a scale of 1:500,000 (about 8 miles to the inch), which was prepared in cooperation with the Oklahoma Planning and Resources Board, the Oklahoma Geological Survey, and other state agencies, and the Geological Survey. The base map shows roads in red, drainage in blue and green, and land grid, railroads, and cities in black.

The map shows, by numerous color patterns, the areal distribution and extent of more than 125 different rock units ranging from ancient granites of



Production tests are under way at Stanolind 1 Crim, southeastern Centrahoma field well. Oil Creek production has been proved on tests.

pre-Cambrian age to alluvial deposits of sand and gravel along streams, and including many of the formations famed for their contribution to Oklahoma's great production of oil and gas. The principal dislocations (faults) in the earth's cruse that offset these rock units also are shown. The sources of the data compiled on the map are shown on a small index map that shows the contributions to the map of more than 75 individuals and organizations.

KANSAS

State Has Five New Discoveries Promised

Five new oil discoveries are promised Kansas areas. In Barber County E. H. Adair 1 Bloom, NE NE NW 23-32s-12w, 2 miles southwest of Medicine Lodge, reported a good recovery of oil in the Mississippian.

In Barton County Francis Raymond 1 Praeger, NE NE NE 3-18s-11w, is a good new Lansing oil prospect. It recovered 300 ft. of oil at 3,032-62 ft. This well is ½ mile east of Claflin and 1 mile northeast of new Claflin field.

In Kiowa County Gulf Oil Corp.'s 1 Pyle, NE NE NE 16-29s-16w, swabbed 161 bbl. of oil in 10 hours. McPherson County has a new prospect at Rupp-Ferguson 1 Lundstrom, SW SW NW 6-18s-3w. This well swabbed 12 bbl. of oil in 2 hours from the Simpson-Ordovician sand. Testing continues. In Rooks County Petroleu, Inc. reported 21 bbl. of oil per hour at 1 Carmichael, NE NW SW 33-8s-18w. This Lansing well is 1 mile southwest of abandoned Hobart field. It is 1½ miles northwest of Yohe field oil production.

Mississippi Oil Shows At Harper County Test

In the area 1 mile southeast of Grabs field production in Harper County, Musgrove Petroleum Co. has a good new producer at 1 Burgess, NW NW SW 21-31s-8w.

Recovery was 75 ft. of very heavy oil and gas-cut mud, 210 ft. of free oil and 30 ft. of water on drill-stem test at 4,377-93 ft.

Committee Names Eight New Fields in Kansas

Kansas has eight new producing areas, recently named by the Nomenclature Committee.

In Barton County Hoisington Southwest pool was opened at J. F. Darby 1 Hull, SL SW SE 20-17s-13w. The well is completing in the Arbuckle. Also in Barton South Bend field was opened at Schermerhorn Oil Corp. and Thunderbird Drilling Co. 1 Hart, NE NE NW 9-20s-13w. This well is completing in the Lansing.

Morrison Northeast pool was opened at Shamrock Oil & Gas Co. 1 Stephens, C SE SE 10-32s-21w, Clark County. This is a Morrow sand discovery. In Ellis County on the Central Kansas uplift Herman field was opened at Mallonee Drilling Co. 1 Herman, NW NW NE 28-13s-20w. It is completing in the Arbuckle lime.

Hoof pool was opened at Imperial Drilling Co.'s 1 Hoof "A," NE NE SW 9-10s-23w, Graham County, also on the uplift. This well made 3,000 bbl. of oil potential per day from the Lansing lime. Youk pool was opened in Marion County at Anderson-Prichard 2 Youk, NL S½ S½ 20-18s-2e. This is a Viola lime producer. Wolf Creek pool was opened at Jones, Shelburne & Farmer 1 Bales, NE NE SW 16-4s-19w, Phillips County in northern Kansas. The well is finishing up in the Lansing lime. In Rush County Webs pool was opened at Republic Natural Gas Co. 1 Webs "C," NE NE NE 16 19s-20w. It is completing in a basal Pennsylvanian sand pay.

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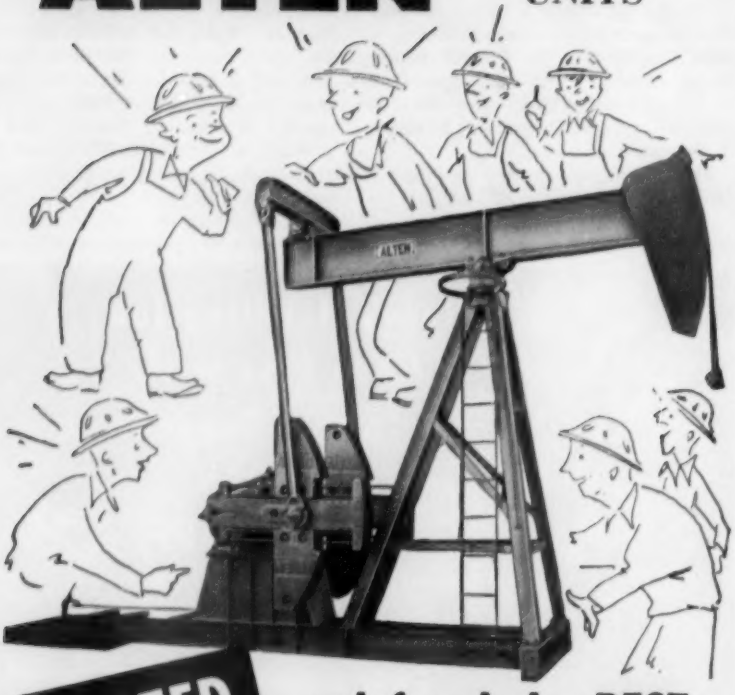

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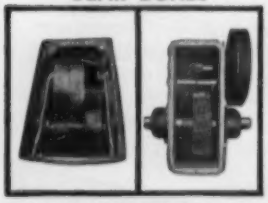

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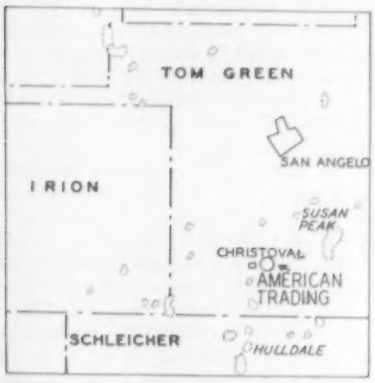
WEST TEXAS

County Park in Tom Green County Has First Well

Strawn oil production has been opened on Tom Green County's public park land, 1½ miles east of Christoval townsite. The new well is American Trading and Production Corp. 1 Tom Green County.

On completion test, a 14-hour flow of 129.26 bbl. of 40° oil gas the well a daily potential of 221.5 bbl. Tubing choke was 24/64-in., pay was perforated at 5,359-71 ft., pressure was 180 psi. and gas-oil ratio was 751:1.



Southern Tom Green County's newest Strawn strike. American Trading 1 Tom Green County, on County Park land southeast of Christoval.

Tests in the Strawn reef at 5,720-40 ft. also indicated commercial production from that zone. Pan American skidded the rig one location west for a second test.

This area of the county attracted attention early in the year, and during 1954 has accounted for discoveries at Pecan Station, South Christoval, H. J. Strawn, Atrice, and one undesignated. Park land was purchased by the county in 1941 from the J. P. Pugh ranch.

Pecan Station-Strawn field, northwest of Susan Peak field, gained a second producer and northwest extension at Ada Oil Co. 2-5 Johnson. Potential from pay at 4,958-82 ft. was 177 bbl. a day.

Crane County . . . Gulf Oil Corp. 2-A Dawson estate, 12-6-H&TC Survey, has been plugged back and completed as a Devonian discovery. Location is approximately 1½ miles northwest of similar production at Eppenauer field.

On completion test from open hole at 5,150-5,230 ft. the well flowed 383.6 bbl. of oil a day through 14/64-in. choke. Gas-oil ratio was 1,505:1, grav-

ity 42.8° and tubing pressure was 475 psi.

Andrews County . . . Skelly Oil Co. 1 Frank Orson, 6 miles southeast of Andrews, reported oil and salt water on drill-stem test of the Ellenburger. Top of the formation by samples was 14,292 ft., minus 11,216 ft. The test from 14,274-14,323 ft., open 3 hours, returned 2,580 ft. of free oil, water blanket, and 1,650 ft. of salt water cut mud.

SOUTHEAST NEW MEXICO

Gas-Distillate Discovery Completed in Lea County

Lea County gained another high-gravity discovery at Continental Oil Co. 1 West Anderson Ranch Unit, in 6-16s-32e, 4 miles northwest of Anderson Ranch field.

Initial potential was 360 bbl. of 50° oil through ½-in. choke, plus an estimated open-flow gas volume of 5,000 M.c.f. per day. Pay section was perforated at 12,512-30 and 12,542-50 ft. Flowing pressure on tubing was 750 psi.

The well was drilled to 14,015 ft., in the Devonian, then plugged back.

GULF COAST

SOUTHWEST TEXAS

Pumper Opens New Field

O'Leary Royalty Co. has a new pumping oil-discovery well 5 miles west of Luling, in Caldwell County. The well, 1 O'Banion, is good for 91 bbl. of 37°-gravity oil per day. Production is from casing-perforated interval at 1,932-2,036 ft. in hole bottomed at 2,206 ft. Drilling is under way at the company's second test, 1 Richardson, ½ mile to the east.

Cameron Gets New Pay

A new pay zone has been established in Cameron field, Starr County, with completion by W. U. Paul of his 2 Lyons et al as an 83-bbl. producer, flowing through ⅛-in. choke, from perforated interval at 4,230-36 ft. Flow was under pressure of 545 psi. Gas-oil ratio measured 303 cu. ft. per barrel. Gravity of the oil is 45.1°.

SOUTH LOUISIANA

New Oil Producer Extends East Lake Palourde Field

Production at East Lake Palourde field is being extended approximately 4,000 ft. westward with completion by Humble Oil & Refining Co. of its 1 Norman Breaux as a good oil well in sand at 12,702-06 ft.

This is Humble's first well in multi-pay area, opened last April by Union Oil Co. of California. Completion gage was 240 bbl. of 35.2°-gravity oil per day through ⅛-in. choke. Flowing pressure was 2,900 psi.

Completion of Humble's well follows a ¾-mile southwest extension the previous week by Union Oil Co. at its 1-A Norman et al, flowing 300 bbl. of 39.4°-gravity oil per day through 8/64-in. choke from perforations at 13,388-98 ft.

California Co. has moved productive limits a location east at its 2 Lutcher-Moore, completed the past week as a gas-condensate well in sand at 13,148-90 ft. The well tested 96 bbl. of condensate per day with gas ratio of 31,250 cu. ft. per barrel of liquid, flowing through 12/64-in. choke. Pressure was 4,575 psi. Gravity of the condensate was 47.2°. It is California Co.'s second well.

The field now has 6 oil and 3 gas wells.

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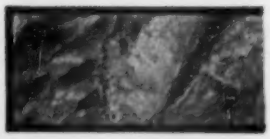

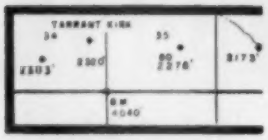

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Second Well Testing in New Far-Offshore Field

Testing is under way at Continental Oil Co.'s second well in the recently opened East Cameron Block 71 field, in the Gulf of Mexico, 17 miles off the coast of Cameron Parish.

Initial tests have been in sand interval at 8,770-76 ft., 700 ft. deeper than the discovery well's pay zone. Through ¼-in. choke, flow was at the rate of 5,275,000 cu. ft. of gas and 53 bbl. of condensate per day.

Higher sands will be tested before the well is completed.

Discovery well was completed last October as a gas-condensate producer from pay interval at 8,066-80 ft.

Hollingsworth Discovery Confirmed by Second Well

Byrd Oil Corp. has confirmed Texas Gulf Producing Co.'s recent gas-condensate discovery in the Hollingsworth area, northwest of Fulton, in Beauregard Parish.

Byrd's well, 1 Barbe, ½ mile southwest of the discovery producer, flowed at the rate of 1,475,000 cu. ft. of gas per day through chokes, recovering 51.8 bbl. of 61.6°-gravity condensate per million cubic feet.

Production is from the discovery well's lower Frio sand with perforated interval at 7,262-70 ft. The discovery well's interval is 7,275-80 ft.

Pine Prairie Spreads

Cockfield production on the Pine Prairie dome, in Evangeline Parish, is being extended farther northeastward by Atlantic Refining Co. at its 1 Evangeline.

The well, completed in pay interval at 8,310-16 ft., flowed at the rate of 139 bbl. of clean oil per day through ⅛-in. choke with pressure of 1,200 psi. and gas-oil ratio of 725 cu. ft. per barrel. Total depth is 11,011 ft.

TEXAS GULF COAST

New Oil Discovery Made In Beech Creek District

American Republics Corp. and Houston Oil Co., joint operators, are opening a new oil-productive reservoir in the Beech Creek area, 11 miles north of Silsbee, in Hardin County. Discovery well, their 1 H&TC, in Section 197, is 1¼ miles northeast of Beech Creek field, and about midway between East and West Beech Creek fields. Testing casing-perforated interval at 6,349-53 ft., the well flowed at the rate of 129 bbl. of net oil with 10 per cent salt

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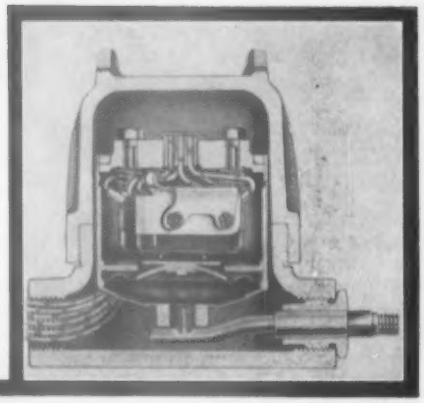

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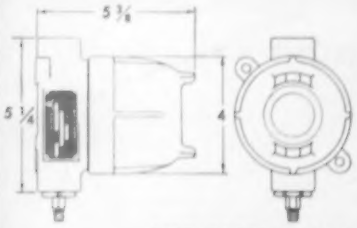

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water per day through 7/64-in. choke. Flowing pressure was 975 psi. and gas-oil ratio 795 cu. ft. per barrel.

Victoria County Wildcat Makes Dry Gas Producer

Wymore Oil Co. has a new gas-discovery well 10 miles west of Victoria, in extreme western Victoria County. Completed in sand interval 4,138-44 ft., the well, 1 Terrell, flowed at the rate of 8,500,000 cu. ft. of gas per day. Flowing pressure in tests through ¼-in. choke was 1,376 psi. Shut-in pressure is 1,540 psi. The discovery is designated tentatively as West Cologne field. Hole was drilled to 5,172 ft. Location is in the Peter Teal Survey.

"Dry Hole" Is Pumper

A previously abandoned wildcat located 4 miles north of Crosby, in northeastern Harris County, has been reworked and completed as a small pumper. The well, 1 Sodek, drilled by Brewster & Bartle Drilling Co. to 9,147 ft., was taken over by John W. Anderson and E. J. Jones, who plugged back and perforated at 8,142-52 ft. It pumped 15 bbl. daily, making about 50 per cent water. Location is slightly less than a mile southeast of Rankin field.

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SOUTHWEST KANSAS

Pump Being Installed at Kiowa County Discovery

Falcon-Seaboard and Gulf Oil Corp. 1 Pyle, NE NE 16-29s-16w, is a new discovery for southwestern Kansas' Kiowa County. The operation swabbed 6 bbl. of oil hourly from perforations at 4,670-74 ft. from the Mississippian. From perforations and fracture at 4,664-76 ft. the discovery swabbed 20 bbl. of oil per hour for 2 hours. It then swabbed 160 bbl. of oil in 10 hours.

Hamilton County Discovery Has Casing Set, Will Perforate

United Producing Co. has set production string at 5,220 ft. and will perforate at 1 Helfrich, remote Hamilton County Pennsylvanian prospect.

The wildcat, located in SE SE 6-25s-42w, 12 miles southwest of the town of Syracuse, Kans., recovered oil from the Cherokee sand. The indicated pool, which would open first production of oil in the county, is 4½ miles east of the Colorado line. It is about 20 miles northwest of Hugoton field Permian gas production. Closest oil production is 56 miles to the south at Morton County's Interstate field in the Greenwood area.

TEXAS PANHANDLE

Hansford Morrow Gas Well Awaiting Its Potential

A reworked abandonment in Hansford County's central area is now awaiting potential as a new Morrow gas discovery well. It is the R. H. Fulton 1 Chas. O'Laughlin, Section 19, Block 2, WCRR Survey, 5½ miles northeast of Spearman and 3½ miles southeast of Twin-Morrow sand oil field.

The discovery gaged 1,425 M.c.f. of gas per day with a distillate show from perforations in the Morrow-Penn sand at 7,358-66 ft.

Rank Hemphill County Test Recovered Distillate

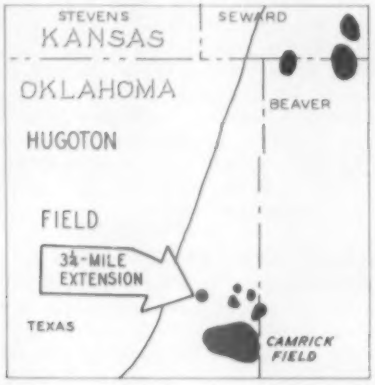
Distillate shows were reported at a remote wildcat in Hemphill County, 2½ miles northwest of Canadian and

23 miles southeast of Lips Ranch field.

Sun Oil Co. 1 Dale Nix, Section 81, Block 42, H&TC Survey, reported the distillate showings on a drill-stem test at 9,760-9,836 ft. in the Lower Pennsylvanian.

OKLAHOMA PANHANDLE

Major Extension Well at Camrick Field Shut in



A major ¾-mile northwest extension to southeastern Texas County's Camrick field in the Oklahoma Panhandle has been shut in after flowing 8,768 M.c.f. of gas per day natural from Morrow sand.

A ½-mile northwest extension to Camrick field in southeastern Texas County has been shut in as a successful major extension well.

Kansas-Nebraska Natural Gas Co. 1 Brown, NW NW SE 25-2n-18eCM, flowed 8,768 M.c.f. of gas per day, natural from Morrow perforations at 6,442-6,521 ft. The new success is located on the east flank of Permian Hugoton field production. It is separated from Grand Valley field on the east by a dry hole.

Third pay seen . . . In Camrick field itself Cities Service Oil Co. 1-B Mathewson, NW SE 19-1n-19eCM, a south offset and confirmation to Lansing-Topeka pay reported at American Gas Producing Co. 1-E Johnson, is an indicated Topeka discovery.

Beaver County Area Has Morrow Discovery Indicated

A new Morrow gas discovery is indicated in Beaver County at O. H. Parker 1 Hennigh, NW NW 28-6n-28eCM, 7 miles north of Gate City and 3½ miles southwest of 1-well southeast Greenwood field.

The wildcat got gas in the Morrow at 6,087-97 ft.

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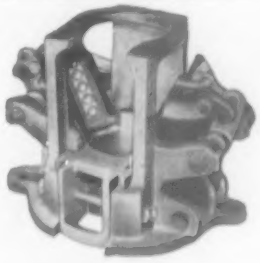

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GREAT LAKES

MICHIGAN

Northville Trenton Pool Output Flowing Oil

John Parrish 1 Shaw, SW NW NW 36-1n-7e, Lyon Township wildcat, Oakland County, an outpost north of the Northville Trenton oil and gas pool, and the newest sensation in the area, flowed at a restricted rate of 174 bbl. of oil in 24 hours on various days of testing after a 500-gal. acidization.

Well flowed at that rate for about 5 days before being shut in. The next day well was opened again, would not flow and has been shut in since that time. Operators are considering reacidizing this wildcat again. The 1 Shaw is located over 1 mile north of the nearest producer in Northville pool, and is probably on a different feature.

● Taggart Co. 1 George et al, SW NE NE 18-1s-8e, Northville Township, Wayne County, a dry Trenton test on the southeast side of Northville pool, logged a show of free oil below the base of the Black River formation, perhaps in the St. Peter. This oil show, however, exhausted and well was being deepened. The Black River base was logged at 4,810 ft. Oil show was logged at 4,881-84 ft. Hole filled 100 ft. with oil in 2 hours, but during the next 6 to 8 hours, oil had been exhausted by bailing.

● First follow-up test in the new Ensley Traverse oil pool, Newayo County, logged Traverse lime top at 2,429 ft., and two possible pay sections were logged in this objective. This first test to reach the Traverse was the west 20-acre offset to the discovery, the James J. McGerry, Trustee 1 Butler, NE NW NW 7-11n-11w. Offset was reported to be about 6 ft. lower on the Traverse objective than the 1 Cook discovery producer. First pay was cored from 2,436-40 ft., and another, less promising, porosity zone was cored at 2,450-51 ft. Well was cored to 2,472 ft., total depth, where 5-in. casing was run and cemented. Pay zones will be perforated and tested within the next week.

EASTERN CANADA

Oil Springs . . . In the old Oil Springs shallow field, Lambton County, early results of tests of the secondary recovery installations made by Nye De Mers and associates indicate increased production.

In the initial unit, gas and later water under high pressure are forced into four outlying injection wells, drilled to about 415 ft., to force oil from a centrally-located production well. The process is expected to increase, production, originally averaging a few gallons, to 15 bbl. daily.

Plans are being made for a similar installation in Petrolia field, with drilling there to commence within 2 months. Another $100,000 plant is planned for Oil Springs field.

EASTERN INTERIOR

WESTERN KENTUCKY

In McLean County, 5 miles northeast of Sebree, Ellis-Morrison-Damron & Sun Oil Co. 1 Hunt-Jewell heirs-Fireline, 9-N-25, ½ mile southeast outpost to Comer pool, made 70 bbl. of oil per day from the Tar Springs at 1,688-97 ft. for a new-pay discovery for the area.

ILLINOIS

In Gallatin County, 5 miles southeast of Omaha, O. W. Mayhew et al 2 Mills, NE SW SW 4-8s-9e, is flowing 5 bbl. of oil per hour through ¼-in. choke after fracturing. The pay is the Aux Vases sand at 2,916-38 ft.

● In Marion County Union Contracting & Engineering Co. 1 Hawkins, SE SW SW 29-1n-4e, 10 miles southeast of Salem, is being put on the pump to test the St. Louis lime at 2,881-

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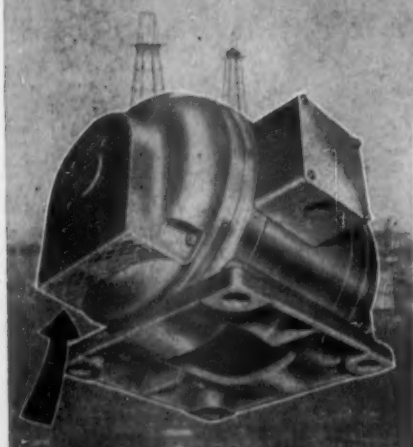

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2,910 ft. The well swabbed 5 bbl. of oil per hour natural.

● In Edwards County, 2 miles southwest of West Salem, Skiles Oil Co. of Mt. Carmel, is completing at 1 Bunting "A," SW SW SE 24-1n-10e. A 1-hour drill-stem test in the O'Hara lime at 3,180-99 ft. recovered 2,100 ft. of clean oil, 620 ft. of mud-cut oil and 120 ft. oil-cut mud. Bottom-hole pressure was 1,353 psi.

● White County's new producing area east of Carmi has another new oil well. It is Ryan Oil Co.'s 2 Henning in the area around 19-5s-14w. The well pumped 300 bbl. of oil per day after fracture treatment in the Aux Vases at 2,943-72 ft.

APPALACHIAN

PENNSYLVANIA

In Banks Township, Indiana County, Southwest Pennsylvania, Keta Oil & Gas Co.-Columbian Carbon Co. 1802 Farmers & Miners Trust Co., was completed gaging 431,000 cu. ft., gas rock pressure 3,820 psi. in 42 hours, chert 7,488 ft., Oriskany sand 7,564 ft., TD 7,600 ft.

● In 1954 there were 12 wildcat completions reported in Southwest Pennsylvania. Only 1 resulted in gas and 11 were dry. The footage was 95,222 ft. Development completions reported were 157, of which 2 were oil, 120 gas and 35 dry, with a footage of 398,440 ft.

WEST VIRGINIA

Huntersville district, Pocahontas County, West Virginia United Fuel Gas Co. 8176 S. M. Chapman, rank wildcat ran the 7-in. casing at 3,308 ft., and is drilling at 3,395 ft. Union district, Preston County, Columbian Carbon Co. 1207 L. D. Burger, is drilling at 2,300 ft.

● In 1954 there were 51 wildcat completions reported in West Virginia of which 31 were gas and 20 dry. The footage was 161,447 ft. Development completions reported were 563, of which 67 were oil, 396 gas and 100 dry, with a footage of 1,543,273 ft.

OHIO

An offset to a dry hole ⅖ mile from the nearest production resulted in a 200 bbl. well for National Gas Corp. on 2 Finley King, Section 6, Hopewell Township, Perry County. Clinton at 2,709-38 ft. showed 3 bbl. natural and was fractured.

In Clay Township, Tuscarawas County, an extension to the No. 2 pool was completed by the Belden Face Brick on Fee property. Berea sand, topped at 901 ft., was drilled to 905 ft. with a gage of 1,200,000 cu. ft. natural. A third well was added to the No. 3 pool by Robert Stewart et al on 1 F. Schupp, Section 22. Berea was logged at 1,165-1,221 ft. with 350,000 cu. ft. natural.

EASTERN KENTUCKY

United Fuel Gas Co. have abandoned their wildcat test on Collins Branch Breathitt County. The 1 Kathryn Arnett et al had Berea sand at 1,650 ft., Corniferous lime at 2,069 ft., Big Six sand 2,273 ft., and Clinton sand 2,696 ft. Hole was drilled to 2,735 ft. total depth. Gas shows in the Berea and Corniferous failed to make a commercial well after shooting both zones.

PACIFIC COAST

CALIFORNIA

Tejon-Grapevine Well Testing Deeper Pay

Outcome of a flank well in the 5,600-ft. Olcese pool at Tejon-Grapevine field, Kern County, was being closely watched as the result of a formation test in a deeper zone. Reserve Oil & Gas Co. 12-34 Reserve-Pauley at 6,685-6,728 ft. yielded 600 ft. of condensate and gas-cut mud after a 30-minute test. During the test gas flow was estimated to be in excess of 5,000 M.c.f. daily.

Located in NW NW 34-11n-19w, the test is approximately ¾-mile northeast of a Jewett zone discovery completed last month in SE NW Section 33. Drilling & Production Co. 33 J.V. found the Olcese nonproductive but was completed flowing 495 bbl. of 38°-gravity crude daily from the interval 7,007-39 ft. Yet to be determined is whether Reserve 12-34 tested an upstructure gas cap in the Jewett or if it is a new pay zone. At last reports the well was drilling below 6,950 ft.

Sunset Beach Test Plugged Back

A northeast extension attempt to Sunset Beach field, Orange County, apparently failed to find production in either of two pays. Hedges-Smith-Erlich 1 Phelps, in SE NW 20-5s-11w, was plugging back after running formation tests at 8,306 ft. If unsuccessful, it would be the first failure of seven tests drilled along a 2½-mile trend between Seal Beach and Huntington Beach fields.

The Phelps test is approximately ⅓ mile east of thhe Sunset discovery well, Bert Aston 1 Lomita, which was completed last June in a 7,100-ft. zone believed equivalent to McGrath pool at Seal Beach. It is a similar distance north of W. L. Meeker 1 Lomita Land, completed last month in an 8,000 ft. sand believed equivalent to Huntington Beach's Ashton pool.

South of the latter well about ½ mile, along the boundary between Sections 20 and 29, Atlantic Oil Co. had two wells under way toward the deeper objective. A new test preparing to get under way east of the Atlantic wells was Albercalif Petroleum 11 Holbrook-Isbell et al in SW SW Section 20.

Beach Boom Growing

The Jones sand discovery on the southeast end of Huntington Beach field, Orange County, was fast assuming the proportions of older portions of the field. At the first of last week four wells had been completed in the 3,800-ft. pay, all within the same city block. An additional 12 rigs were at work on nearby locations and still other locations were being prepared, with an objective of either the Jones sand or a 5,500 ft. sand.

While size of the Jones pool is not expected to be large, acre-foot yields are expected to be high. Some geologists familiar with the field do not expect the new pool to exceed 50 acres in size.

New Yolo Gas Pool

Bandini Petroleum Corp. 1 Griffin was successfully completed as a new McCune sand discovery in the North Winters gas field, Yolo County. Located in 1-8n-1w, the well was completed flowing at a 5,000 M.c.f. daily rate through a ¼-in. choke, producing from the interval 4,712-25 and 4,729-33 ft.

Washington Test Abandoned

Continental Oil Co. has abandoned 1 G. Hogan in Grays Harbor County, Washington, after drilling to 3,952 ft. The test, in 22-16n-9w was the sixth dry hole drilled by the company since starting the exploratory program last spring. Location for a seventh test is to be announced in the near future.

WESTERN CANADA

MANITOBA

Two Province Wells Have Indicated Oil Production

Dome Exploration (Western), Ltd., reported the running of production casing at a pair of Manitoba wildcats, fol-

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lowing drill-stem tests in the Mississippian formation that indicated oil discovery.

One of the wells, Dome et al 13-9 West Ebor, LSD 13, 9-9-29w1, is 3 miles southwest of Ebor oil pool. The other well, Dome et al 13-26 South Harmsworth, LSD 13, 26-11-26w1, is 3 miles northeast of oil production and 6¾ miles north of Virden town.

ALBERTA

Triassic Oil Discovered At Buffalo Lake Wildcat

Sinclair Canada Oils and Banff Oil, Ltd., have discovered oil in the Triassic sand at their wildcat in the Buffalo Lake area of northwestern Alberta.

Sinclair-Banff 1 Buffalo Lake Crown, LSD 7, 26-74-8w6, is 20 miles northwest of Grande Prairie and 90 miles southwest of Peace River town. Recovery on tests amounted to 2,260 ft. of dark green 29°-gravity oil. Crew is to test the Jurassic.

Gas Flowed at Prolific Rate at Savanna Creek

A third porous zone in the Rundle lime at the Savanna Creek prolific natural gas discovery has flowed at the maximum rate of 15,840 M.c.f. per day, following perforations and acidization.

The well, Husky-Northern-Target 1 Savanna Creek, LSD 12, 20-14-4w5, is 25 miles southwest of Turner Valley and 60 miles southwest of Calgary. Perforations in the production casing were made opposite the formation known as the lower Rundle (Madison lime). The well has a cumulative gas flow rate from three zones of 46,500 M.c.f. per day.

ROCKY MOUNTAIN

UTAH

Big Flat Wildcat Recovers Oil

King Oil Co. has reported recovery of 2,180 ft. of oil on 4½-hour drill-stem test of 2 Unit, SW SE SE 11-26s-19e, in the Big Flat area of Grand County. The wildcat is 12 miles west of Moab. Test was of the zone 7,815-49 ft. Top of Mississippian was called at 7,780 ft. Oil was 43° gravity. The well blew out in Paradox (Pennsylvanian) below 4,300 ft., and was shut down for some time. The operator whipstocked when operations resumed.

Shell Oil Co.'s discovery in the Desert Creek area of San Juan County last year gave the Paradox basin its first commercial producer. The King Oil wildcat is also in the Paradox basin. Other shows recently reported in the basin have been in Pennsylvanian, with no Mississippian prospects noted prior to the King Oil wildcat in recent months.

MONTANA

Roosevelt County Wildcat Near Test

Deep Rock Oil Corp. will run casing at 1 LePage, C NW SW 14-21n-59e, in Roosevelt County. Total depth is 9,548 ft. in Madison. The well had shows in Charles and Mission Canyon, with cores showing oil stain, but with very little porosity and permeability. Drill-stem tests have recovered only mud. The operator will acidize zones which appeared promising on log.

Southwestern Montana Shows Rumored

Beaverhead Oil Co. has neither confirmed or denied reports of shows at its 1 Hansen, NW SW SW 2-10s-12w, in the Medicine Lodge area of Beaverhead County. The well was spudded 6

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THE OIL AND GAS JOURNAL

"Almost missed you—Goin' to town, Boss?"

months ago and is now unofficially reported in Devonian at about 4,200 ft. Drilling is with cable tools. It has been operated completely tight, and no verification of rumors of shows is available. Some leasing through the rather isolated area has been done on the basis of rumors in circulation.

Northwest Sumatra Stepout Tested

The Texas Co. reported a flow of oil after 85 minutes of a 1-hour-55-minute test at 1 Red Wing Potteries, C NW SW 18-11n-33e, in the Northwest Sumatra area of Rosebud County. Test was of upper Heath at 4,893-4,935 ft. The well is ¾ mile east of previous production in the field, with one failure intervening between it and the field proper.

WYOMING

Goshen County Wildcat Recovers Oil

F. R. Anderson et al have run casing and will test "J" sand at 24-D-33 Airport, SE SE SW 33-24n-61w, in the Torrington area of Goshen County. Drill-stem test of "J" sand recovered 265 ft. of high gravity oil. The operator topped "J" sand at 6,923 ft. and has set pipe to 6,940 ft. The well is more than 40 miles from nearest production in the Denver-Julesburg basin. It is on the northeastern flank of the basin where there has been only scattered drilling with very little encouragement.

Oil has been recovered from a rank wildcat in Goshen County in the far northwestern reaches of the Denver-Julesburg basin. Nearest basin production is in Nebraska's Harrisburg field, 40 miles southeast.

Washakie County Tight Hole Near Completion

Sohio Petroleum Co. is running pipe at 1 Unit, SE SE SE 36-44n-91w, Washakie County. The well was drilled to a total depth of 6,418 ft. without release of any information as to tops and tests. It is the first test on the 7,000 acre Water Creek unit, about 5 miles north of Black Mountain field where production is from Embar and Tensleep.

COLORADO

Elbert County Apparent Discovery Installing Pump

Sinclair Oil & Gas Co. is installing pump at 1 Bradbury, NE NE NE 28-6s-61w, Elbert County. Swab recovery in 12 hours was 6 bbl. of oil and 5 of acid water. The wildcat is testing in "J" sand, and is 30 miles south of previous production along the established trend through the Denver-Julesburg basin. Sinclair is continuing an exploratory series in this area.

Shell Oil Co. has opened Colorado's first field for 1955 at 1-A State 694, Logan County. The discovery flowed gas from the Muddy, opening Coyote field.

Morrison Area Wildcat Tested

S. D. Johnson recovered gas with an unmeasured amount of oil on test of 1 Pallaoro, SW NE NW 7-5s-69w, Jefferson County. The operator reported recovery of 6,500 ft. of high gravity oil on drill-stem test 8,958-9,003 ft. several weeks ago. The well was drilled to an undisclosed depth below 9,600 ft., believed to be in Dakota. Total depth and casing depth has not been released. On first tests since casing was set, the interval 8,956-80 ft. was tested. Gas flowed to a flare estimated at more than 50 ft. Some observers credited the well with as much as 50 bbl. of oil per hour, others with very little oil. Johnson has installed separators and is continuing tests.

The well is 15 miles southwest of Denver in the highly faulted mountain front area. Only a very little drilling has been done in the general area. The top of Codell was called at 8,974 ft. and an unidentified limestone at 8,944 ft. Both formations were included in the test. Similar producing zones are not known in the Denver-Julesburg basin proper. A successful completion will attract further exploration along the mountain front. Johnson has already scheduled another wildcat to the north in the Golden Area, several miles from the discovery. A confirmation well will not be drilled immediately.

Casing Set At Raton Basin Wildcat

Lewis Exploration Co. has run pipe at 1 Dutto & Marchisio, NW NW NE 27-33s-62w, Las Animas County. This operator has taken the well over from Bruce Sullivan and Jay Taylor under agreement to set pipe and attempt completion. The wildcat was shut down for some time with fish in hole. Shows were logged in Madera. Test of this formation recovered 75 ft. of heavily oil and gas-cut mud and 1½ ft. of free oil. Lewis has conducted sporadic exploration through this area for several years.

NORTHERN NEW MEXICO

Deep Rio Arriba County Test Staked

Magnolia Petroleum Co. has made location for a wildcat 15 miles southwest of Lindrith in Rio Arriba County. It is 1 Jicarilla Tribal, SE NW NW 33-23n-4w, and is to test Entrada at about 7,800 ft. Nearest production is from Humble Oil Co.'s 1954 discovery at 1 Jicarilla, C NW NW 15-23n-5w, which found production of 20 bbl. of distillate, 875,000 cu. ft. of gas and 13 bbl. of water per day in Dakota at 6,663-75 ft.

Successful Wildcats

SOUTHWEST TEXAS

Atascosa County: Rodney De Lange et al 1 Wilson, James Barclay Sur., A-68 (½ mile southeast of Crown). IP 104.85 BOPD, 8/64-in., 40.8°, Navarro 4,294-4,313 ft. (perforations). TD 4,352 ft. (New field.)

Zapata County: Alaska Steamship Co., Texita Oil Co., and E. W. Gill 1 Cuellar, Porcion 33 (4 miles east of Zapata). IP 2,850 M.c.f. daily, open-flow potential, dry gas, perforations 4,710-20 ft. TD 5,041 ft. (New field.)

TEXAS GULF COAST

Bee County: Humble Oil & Refining Co. 1 Carpenter, R. P. Little Sur., A-464. IP 5,410 M.c.f. daily, calculated open-flow potential, perforations 9,114-28 ft. TD 9,475 ft. (New field—1¼ miles east of Theis field.)

Colorado County: C. N. Housh and American Republics Corp. 1 Papenberg, E. Tumlinson Sur., A-44. IPP 1,020 M.c.f. daily,

(Continued on page 179)

PERSONALS

Big Man, Big Job

Arps, 6 ft., 5 in. tall, is still gaining stature

THOUGH British-American Oil Producing Co. probably isn't aware of this, it can consider itself lucky that its Vice President John Arps is an unusually tall man.

Arps, recently named B-A's vice president in charge of the economics and evaluation department at Dallas, is a native Hollander. His home town was The Hague, and he was educated at the Technical University at Delft from which he was graduated cum laude in 1932 in the midst of the depression with a master's degree in mining engineering and geology.

Between school terms he worked as a roughneck for the Shell organization in oil fields of Romania and as a coal miner in Holland's Limburg province. Arps is 6 ft., 5 in. tall. The tunnels of the Limburg coal mines were only 6 ft. high. Arps decided early that he "didn't want to work stooped over" for the rest of his life.

Enters oil business . . . When he graduated, he applied for a job with Shell and was sent to the Far East to work as a geologist in the jungles of northern Sumatra. This was the first of many assignments which took Arps practically all over the globe.

He spent a year in northern Sumatra, was transferred to southern Sumatra and then to eastern Borneo where he became division exploitation engineer at the age of 25.

Arps was married in 1933. The wedding was performed by proxy, with Arps in Sumatra and his bride, Diderika, in The Hague. The Arps' first of two sons, Jan, was born in eastern Borneo.

Arps was recalled in 1937 to The Hague where he worked on secondary-recovery problems. In 1938, he came to the United States for further training and visited the oil-producing areas in this country.

Settles in U. S. . . . It was during this period that he decided he had found the best place to live and work in the oil business. He was sent to Venezuela on a special assignment by Shell in 1940, but resigned late that year to return to his adopted country and a job with British-American.

His first job with B-A was as district engineer at Houston. He soon was promoted to district superintendent, and in 1943 he was transferred to Tulsa as chief engineer of the company. Promotions continued to come in rapid succession. He was named assistant general production superintendent in 1946, acting production manager 2 years later, and assistant to the executive vice president in 1949. It was during his 9-year stay at Tulsa that he officially adopted the United States as his home. He completed the naturalization process in 1947.

Arps moved to Dallas in 1952 when the company headquarters was shifted there from Tulsa.

Man of many interests . . . Arps has made detailed studies of the economics of the offshore exploring, drilling, and producing phase of the business and of the quantitative use of electric logs and bottom-hole pressure buildup curves in reservoir-engineering evaluations.

Arps calls this engineering technique "listening to what the well has to tell you." If you listen closely enough and apply what is learned, Arps says, you not only can find out how to better produce oil from a reservoir, but you may wind up finding more oil. There have been many cases (and he has documented records to prove it) in which careful study of well data has pointed to large volumes of oil which conventional exploratory techniques failed to find.

Arps, terming himself a "free-lance inventor," has contributed to the science by devising new reservoir-engineering techniques and equipment. He has been granted many patents, most of them dealing with well logging.

One well-known invention is a slide rule which he designed to facilitate the computation of porosity, connate water, and permeability from electric logs. This one, a shortcut for the well-known departure curves, has been made available to the industry. He has devised somewhat similar instruments, for company use only, for computing recovery and other unknowns.

The B-A executive's favorite spare-time activity is probably sailing, although he is interested in photography and has a home workshop.

He owns a 15-ft. snipe in which he can often be found sailing around Dallas' White Rock Lake a few blocks from his home. He also sails in some of the regattas in the Mid-Continent area and has won "some small prizes," although he claims "the boys do much better than I do."

His sons are Jan, 20, a junior at California Institute of Technology, and Ronald, 15, a junior at Hillcrest High School in Dallas.

JOHN OUDING

John Ouding, former refinery superintendent for Wilshire Oil Co., Inc., has been promoted to manager of manufacturing and placed in charge of all refinery operations of the company. Ouding joined Wilshire in 1923 as refinery foreman and was named refinery superintendent in 1952. Also promoted by Wilshire was **Roy Waer,** an employe of the company since 1941, who was named manager of the crude-oil supply and exchange department.

Robert M. (Bob) Becker, former geologist for British-American Oil Producing Co., has resigned to join the Walter Duncan interests at Oklahoma City.

Sir William Fraser, chairman of the British Petroleum Co., Ltd., (formerly Anglo-Iranian Oil Co., Ltd.) since 1941, was one of three British leaders elevated to the House of Lords as barons in the New Year's honors list of Queen Elizabeth II.

E. P. Selle, junior civil engineer in Humble Oil & Refining Co.'s southwest Texas division office, Corpus Christi, has been promoted to associate civil engineer. **E. H. Gallenkamp,** senior civil engineer, gas-construction division, moved to the Tomball, Tex., gas system as district civil engineer. In other Texas personnel changes, Humble transferred **W. B. Burgess** to the East Texas gas plant as superintendent and **William H. Baldwin** to the Heyser gas plant as superintendent. Burgess for-

PERSONALS

merly was superintendent at Heyser, and Baldwin was compressor-plant foreman at Kelsey.

Joseph McCoy, former regional geologist for Sinclair Oil & Gas Co., has become a consultant at Denver.

H. J. MORSMAN

H. J. Morsman, Curacao, Netherlands West Indies, has been named process superintendent for Great Northern Oil Co., St. Paul. Morsman has been with the Royal Dutch-Shell Group at Curacao for 18 years and was first assistant refinery superintendent there before joining Great Northern. He has a doctor's degree in technical sciences from Swiss Federal Technical University, Zurich, Switzerland. Great Northern also announced appointment of **C. W. Gilmore,** Rodeo, Calif., as senior process engineer, and **Robert J. Johnston,** St. Paul, as process engineer. Gilmore, a graduate of Michigan State College, has been process engineer for Union Oil Co. at Rodeo since 1947. Johnston formerly was a process engineer for Socony-Vacuum Oil Co., Inc., at East Chicago. He is a graduate of the University of Minnesota.

C. W. GILMORE

R. J. JOHNSTON

C. L. Albert, former head of Gulf Oil Corp.'s land unit in Tulsa, has been appointed zone exploration manager at Wichita, where the company is establishing zone offices for production and exploration departments. **S. G. Frazier,** former area geologist at Evansville, has been transferred to Wichita as zone geologist. Other personnel transferred to Wichita include **S. H. Letteer,** former area superintendent at Salt Lake City; **W. C. Palmer,** former division reservoir engineer; and **G. C. MacDonald,** former division drilling engineer. In their new assignments, Letteer is assistant zone production superintendent, Palmer is zone petroleum engineer, and MacDonald is zone drilling supervisor.

A. H. Sus, assistant to the president of Sinclair Refining Co., has retired. He had been with Sinclair nearly 35 years.

A. J. Hanners, geologist with Texas Petroleum Co. in Venezuela, has been transferred to the New York office of The Texas Co. **E. O. Hammer,** petroleum engineer, has been added to the staff of Texpet in Venezuela. **J. T. Moir** has been transferred from the petroleum engineering department of Texpet's Colombian division to Trinidad.

C. M. Halstead, Kimball, Neb., has been elected president and director of Wyoming Oil Co., replacing **James R. Macon,** Denver. **Clyde McCoy,** Denver, has been elected a vice president and director of the firm.

H. E. Brandli, president of Cities Service Oil Co. (Pa.), marketing subsidiary in the northeastern United States for Cities Service Co., has retired. **Edward L. Stauffacher,** who has been vice president of Cities Service Oil Co. (Del.), the past 5 years, will succeed Brandli. **John D. King,** Chicago, succeeds Stauffacher as vice president and director of Cities Service Oil Co. (Del.).

Charles A. Linder, Albuquerque, has been elected a director of Three States Natural Gas Co., Dallas. He succeeds Paul B. English, Durango, Colo., who was killed in an airplane crash last November.

W. L. Kygar, president of Continental Pipe Line Co., has been elected to the board of directors of Platte Pipe Line Co. Kygar succeeds **Charles A. Perlitz, Jr.** Perlitz is senior vice president of Continental Oil Co.

Dick T. Fenwick has been promoted to vice president of Southern Production Co., Inc., Fort Worth. He previously was manager of the company's production and operations department and will continue to head the department in this new position. Fenwick has been associated with Southern Production since its organization in 1941 and has held positions as production and drilling engineer, superintendent, chief engineer, and manager of the natural-gasoline and processing departments. A native of Mississippi, he was graduated from Mississippi State College with a degree in civil engineering. He did post-graduate work in petroleum and chemical engineering at the University of Oklahoma.

Ashton B. Geren, Jr., former consulting geologist at San Antonio, has been appointed geologist for W. C. Curry Drilling Co., Ada, Okla.

Walter K. Link, former exploration adviser for International Petroleum Co., Ltd., has resigned to become exploration manager of Petroleo Brasileiro (Petrobras), the Brazilian Government oil organization. Link was associated with the Standard Oil Co. (N. J.) organization for years and was chief geologist for the parent company from 1947 to 1953.

John M. Ballachey has been appointed executive assistant to the general manager of Alberta Gas Trunk Line Co., Ltd. Ballachey had been assistant to the president of the Canadian Petroleum Association since 1951.

J. P. Edwards, San Francisco, executive secretary of Tide Water Associated Oil Co. since 1936, has retired after nearly 4 decades of service with the company and its predecessor. A native of Nebraska, Edwards was appointed assistant secretary of Associated Oil Co., predecessor of the present firm, in 1916. He became corporate secretary of Associated Oil Co. in 1929 and later served as assistant to the president of Tide Water.

L. L. Gray, assistant manager of production in the Tulsa division of Gulf Oil Corp., has been named division gas engineer, and **C. C. Rodd,** another assistant manager of production, has been transferred to Wichita as zone production superintendent. As result of the personnel changes, **E. Hosford** becomes the only assistant production manager in the Tulsa division. Three persons formerly held the title. In other promotions in the Tulsa production division, Gulf named **A. C. Godbold** division petroleum engineer, and **W. B. Davis,** assistant division petroleum engineer. **Charles A. Swartz,** former geophysicist for Union Oil Co., was appointed division geophysicist by Gulf.

PERSONALS

H. L. Patton, geologist with The California Co., has been transferred from Pensacola, Fla., to Bismarck, N. D.

K. C. Vaughan, former manager of field operations for Union Oil Co.'s Pacific Coast division, has been appointed manager of the company's natural-gas and gasoline department. He was replaced by **W. O. Butler,** former superintendent of the coast division at Santa Maria. **J. L. Stair,** former superintendent of the Coalinga division, moved up to replace Butler. Stair's successor is **H. T. Finney,** former drilling superintendent in the company's southern division.

Orville H. Utley has been promoted by Southwestern Petroleum Co., Fort Worth, from vice president to executive vice president in charge of the company's lubricants division. **C. C. Stiles** was promoted to vice president and **W. R. Peden** and **T. B. Williams** to assistant vice presidents.

Charles S. Mitchell, Bartlesville, Okla., former manager of the crude-oil and supply transportation division of Cities Service Oil Co. (Del.), has been appointed manager of all transportation facilities of Cities Service Co., with headquarters in New York. Mitchell is a vice president and director of Cities Service Oil Co. and president of Cities Service Pipe Line Co. He also is director of several other subsidiary and affiliated companies in the Cities Service system. Mitchell has been associated with Cities Service since 1930. He had been manager of the crude-oil supply and transportation division since 1950.

Frank C. Osment has been named assistant chief geologist (programs) for Stanolind Oil & Gas Co. He is being transferred to the company's general office at Tulsa from Houston, where for the past 3½ years he has been division geologist for Stanolind's Texas-Louisiana Gulf Coast division. Osment joined Stanolind in 1945 and served as district geologist at Shreveport before going to Houston as division geologist in 1951. **L. C. Ritts, Jr.,** district exploration superintendent at Lake Charles, La., has been named to succeed Osment at Houston. **L. C. Adams,** who has been district geophysicist at New Orleans, will succeed Ritts, and **J. T. McMaster,** former staff geophysicist at Denver, will fill the vacancy at New Orleans.

Carl Brazell, Newcastle, Wyo., operating partner in Brazell & Wrather, has been elected president of Northeastern Wyoming Oil Producers Association. He succeeds **R. M. Olds,** Casper. Other officers are **H. O. Beadle,** vice president, and **F. B. Thomas,** treasurer.

D. R. McCALLUM

D. R. McCallum, Denver, Rocky Mountain district manager of Sinclair Refining Co., has been named chairman of the Oil Industry Information Committee for Colorado, Wyoming, Montana, Idaho, and Utah. He succeeds **C. D. Hill,** Carter Oil Co., Billings, Mont. McCallum will serve through 1956.

Wallace Cooper and **Bill Wells** have joined White Eagle Oil Co., Midland, Tex., as geologists. Cooper will do subsurface work in Southeast New Mexico and Wells will have the same assignment in West Texas.

John W. Proctor, Edmonton, has been appointed executive secretary of the Alberta division, Canadian Petroleum Association, with headquarters at Calgary. For the past 4 years Proctor has been general manager of Alberta Interfield Gas Lines, Ltd.

Albert T. Pasche has been transferred from Magnolia Pipe Line Co.'s general offices in Dallas to Socony-Vacuum Oil Co., Inc., in New York as chief pipeline engineer of Socony-Vacuum's producing department. He was in Magnolia Pipe Line's engineering department in Dallas. **George A. Seymour** has been promoted to senior mechanical engineer of Magnolia Pipe Line. **J. S. Black, Jr.,** former superintendent of Magnolia Pipe Line's Beaumont district, has been transferred to Socony-Vacuum Oil Co. of Canada, Ltd. **L. J. White,** superintendent of Magnolia Pipe Line's Houston district, has been transferred to Beaumont as superintendent of the newly created Houston-Beaumont district, and the company's Houston district offices have been closed. The company also announced the transfer of **J. R. Dean,** chief gauger of the North Texas and Olden districts, to Beaumont as assistant superintendent of the new district.

Tom L. Ingram has resigned as district geologist for Stanolind Oil & Gas Co. in West Texas to open offices as a consulting geologist in Roswell, N. M. Ingram had worked for Stanolind as district geologist in both Roswell and Midland, Tex.

W. L. Morris, petroleum engineer in Magnolia Petroleum Co.'s Kermit, Tex., producing district, has been named assistant production foreman in that district. **Clifford F. Willmon** has been promoted by Magnolia from assistant foreman in the Duncan, Okla., producing district to production foreman. **W. J. Mannas** and **John W. Strayhorn,** petroleum engineers at Kermit, have been transferred to the Electra, Tex., producing district. Magnolia also transferred **William N. Richardson,** petroleum engineer at Wewoka, Okla., to the Kermit producing district and promoted **John L. Sanders** from junior petroleum engineer to petroleum engineer in the Brownfield producing district. **T. C. Carpenter** has been promoted to assistant general traffic manager in Magnolia's traffic department. He succeeds **F. M. Good,** who retired January 1.

W. C. Lamb, former Tulsa division geophysicist for Gulf Oil Corp., has been named zone exploration manager in the company's newly established zone exploration office at Denver. New zone geologist is **D. R. Callier,** former area geologist at Salt Lake City. The new exploration office will have supervision of area offices at Billings, Mont.; Casper, Wyo.; Denver; Durango, Colo.; and Salt Lake City. **Don Gilkison,** former area manager at Casper, has been named area manager at Denver. **R. K. Kirkbride,** former geologist at Casper, was appointed area geologist in the Denver office. At Casper, **T. C. Wilson,** former area geologist, replaces Gilkison as area manager, and **V. L. White,** former assistant area geologist, is promoted to area geologist.

DEATHS

James Oliver Fox, 79, Dallas independent oil producer and president of Fox-Hart-George Pipe Line Co., died in Dallas January 6.

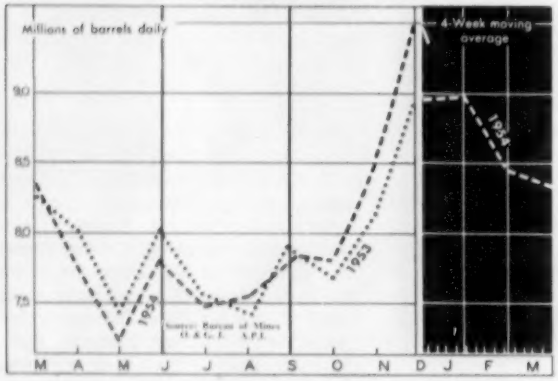
George G. Harrington, 56, vice president and chief engineer of Hunt Tool Co., died recently at Houston. Before joining Hunt Tool in 1943, Harrington was associated with Reed Roller Bit Co. for 19 years.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,556,775	UP	220,775	UP	321,535
Crude stocks	261,486,000	DOWN	3,905,000	DOWN	9,283,000
Completions	1,031	UP	147	UP	97
Refinery runs	7,389,000	UP	93,000	UP	429,000
Gasoline stocks	160,956,000	UP	3,728,000	UP	632,000
Distillate stocks	105,132,000	DOWN	4,499,000	DOWN	1,209,000
Four-product stocks	346,618,000	DOWN	883,000	UP	2,081,000
Total imports	1,351,800	DOWN	91,900	UP	369,500

TOTAL DEMAND—ALL OILS



Group 3 Gasoline and Residual Markets Soften Slightly

SOME tendency toward softer markets for gasoline and residual fuel is reported for the Mid-Continent, but the reasons for the downturn are as widely separated as the two products.

Residual prices on the Group 3 market moved up gradually from a low of $0.95 early in June to $1.50. Many marketers have felt that the shift from residual to other fuels would start when the Group 3 price for residual passed $1.40 a barrel and that the loss would be substantial when the price went to $1.50. This thinking was based on marketing experience of past years.

The low of Group 3 quotations moved up to $1.50 at the end of December. There has been enough decrease in buyer interest since that time to indicate that the consumer is buying no more than current needs at the present price.

The fact that some suppliers announced they had residual available for the next few months seemed to assure the customers that there is little chance of a shortage of fuel.

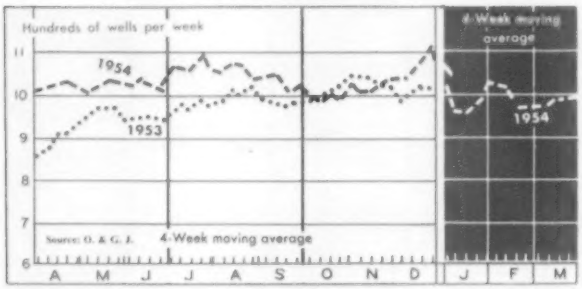
The slight downward trend for gasoline represents a return to market conditions that have existed for better than a year in the Group 3 area. During the early part of the heating season, most of the available space in pipelines to the north was being used for kerosine and distillate fuels. The rush to establish supplies of light fuels at terminals was carried too far in some cases with the result that some points were low on gasoline. This temporary shortage at terminals tended to give an offseason strength to gasoline. With ample supplies of gasoline at terminals, regular grade is available at 10.25 cents a gallon plus pipeline charges from Group 3 refineries.

Gulf-East Coast distillate prices . . . Some marketers on the East Coast are still expecting higher distillate prices to bring a better balance between Gulf Coast and East Coast quotations. Spot rates on clean-tanker movement from the Gulf to the East Coast increased again to boost still further the over-all cost of delivering a spot cargo of distillate to New York Harbor. One fixture was reported at USMC plus 22.5 per cent or about 1.11 cents plus insurance and loss. The over-all transportation cost amounts to almost 1.14 cents per gallon.

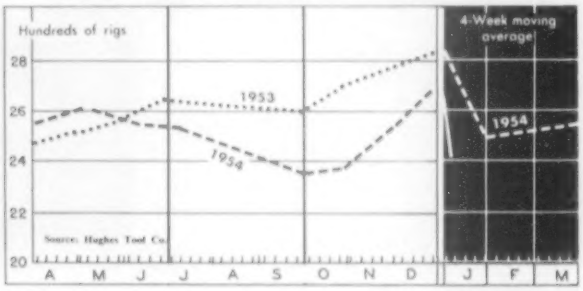
Based on the low of the price range at the gulf for cargo liftings of No. 2 fuel, now quoted at 9.0 cents a gallon, the new spot tanker rate to New York brings the delivered cargo price at that point to about 10.14 cents a gallon compared with a posting for 9.95 cents for barge deliveries within the harbor.

Low crude stocks at year end . . . Not all of the crude reduction reported for the week ended January 1 should be credited to that week. Part of the drop represents correction for previous weeks. Production and imports for the week averaged about 7,167,000 bbl. daily. Refinery runs averaged 7,296,000 bbl. daily and estimates of exports and loss raises the demand figure to 7,346,000 bbl. daily for a stock reduction of 179,000 bbl. daily or 1,250,000 bbl. for the week against a reported drop of 3,900,000 bbl.

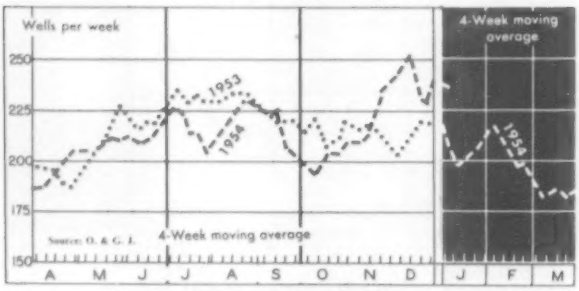
TOTAL COMPLETIONS



ROTARY RIGS OPERATING IN UNITED STATES



WILDCAT COMPLETIONS



ACTIVE ROTARY RIGS

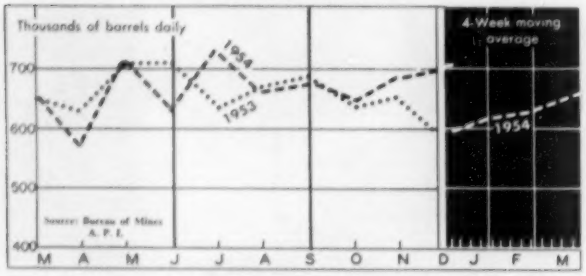
Area—	1-10-55	Change from 1-3-55	Change from 1-11-54
Gulf Coast	552	— 20	
N. and W. Texas-New Mexico	743	— 56	11
Arkansas-N. Louisiana-E. Texas	184	— 14	17
Oklahoma	279	27	— 78
Kansas-S. Nebraska	170	1	35
Illinois-Eastern	112	— 11	— 14
Rocky Mountain	216	— 16	— 56
Pacific Coast	151		— 15
Total United States	2,407	— 89	—100
Western Canada	184	— 3	31

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JANUARY 8, 1955

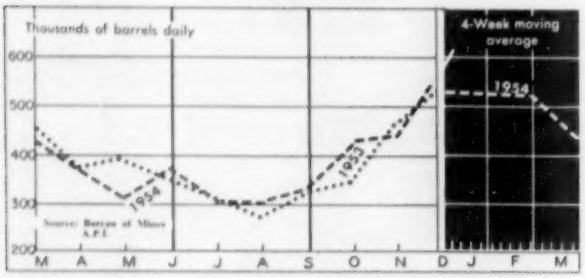
	Total of all wells: Comp.	Oil	Gas	Dry	Footage	Cum. 1955	Cum. 1954	Wildcat completions and discoveries: Oil	Dist.	Gas	Dry	Total	Cumulative total, 1955: Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	3	0	0	3	16,429	3	1	0	0	0	3	3	0	0	0	3	3
Arkansas	10	6	0	4	40,073	10	24	0	0	0	2	2	0	0	0	2	2
California	39	28	2	9	161,709	39	58	0	0	1	7	8	0	0	1	7	8
Colorado	27	6	2	19	137,883	27	18	0	0	1	15	16	0	0	1	15	16
Illinois	71	46	0	25	177,242	71	52	3	0	0	7	10	3	0	0	7	10
Indiana	21	6	0	15	35,718	21	32	1	0	0	8	9	1	0	0	8	9
Kansas	145	69	6	70	499,302	145	59	3	0	0	34	37	3	0	0	34	37
Kentucky	43	14	6	23	81,283	43	28	1	0	0	8	9	1	0	0	8	9
Louisiana	60	38	4	18	377,433	60	70	1	2	3	5	11	1	2	3	5	11
North	29	23	1	5	95,863	29	40	0	2	1	1	4	0	2	1	1	4
South	31	15	3	13	281,570	31	30	1	0	2	4	7	1	0	2	4	7
Michigan	17	5	0	12	41,396	17	11	1	0	0	8	9	1	0	0	8	9
Mississippi	12	6	0	6	91,170	12	6	0	0	0	2	2	0	0	0	2	2
Montana	11	4	0	7	45,946	11	4	1	0	0	3	4	1	0	0	3	4
Nebraska	11	5	0	6	65,791	11	9	1	0	0	4	5	1	0	0	4	5
New Mexico	22	10	4	8	116,226	22	14	0	0	0	6	6	0	0	0	6	6
Northwest	2	0	2	0	6,957	2	2	0	0	0	0	0	0	0	0	0	0
Southeast	20	10	2	8	109,269	20	12	0	0	0	6	6	0	0	0	6	6
North Dakota	4	3	0	1	30,650	4	8	0	0	0	1	1	0	0	0	1	1
Ohio	14	3	3	*8	28,567	14	18	0	0	0	1	1	0	0	0	1	1
Oklahoma	147	78	10	*59	526,042	147	198	1	0	0	18	19	1	0	0	18	19
Pennsylvania-New York	36	10	12	†14	84,675	36	60	0	0	1	0	1	0	0	1	0	1
Texas	323	206	7	110	1,428,744	323	278	13	1	3	69	86	13	1	3	69	86
Southwest (1 & 4)	47	27	3	17	140,867	47	15	1	0	1	10	12	1	0	1	10	12
Gulf Coast (2 & 3)	56	29	4	23	374,848	56	42	2	1	2	16	21	2	1	2	16	21
East (5 & 6)	10	6	0	4	55,005	10	12	1	0	0	2	3	1	0	0	2	3
North Central (7-B & 9)	117	72	0	45	362,845	117	130	8	0	0	24	32	8	0	0	24	32
West (7-C & 8)	85	64	0	21	469,315	85	60	1	0	0	17	18	1	0	0	17	18
Panhandle (10)	8	8	0	0	25,864	8	19	0	0	0	0	0	0	0	0	0	0
Utah	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West Virginia	6	2	3	1	22,542	6	8	0	0	0	0	0	0	0	0	0	0
Wyoming	9	4	0	5	40,875	9	18	0	0	0	3	3	0	0	0	3	3
Miscellaneous	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total United States	**1,031**	549	59	423	4,049,696	1,031	974	26	3	9	204	**242**	26	3	9	204	242
Total previous week	884	472	66	346	3,841,392			27	0	10	209	246					
Total January 9, 1954	934	516	67	351	3,639,670			20	3	4	153	180	28	3	7	184	222

Service wells included *2, †7.

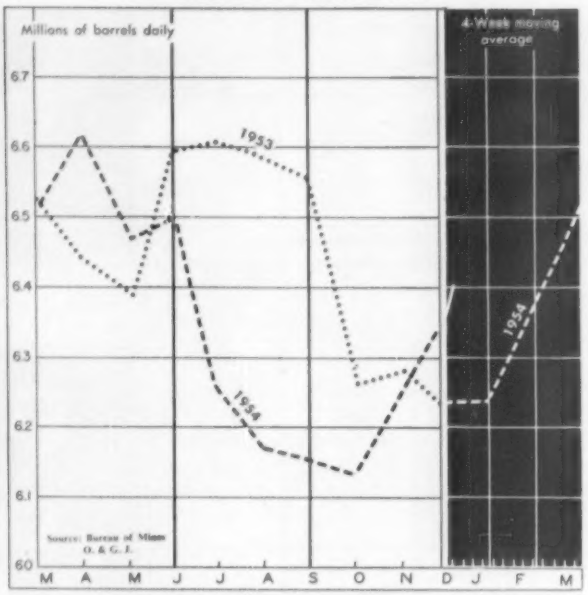
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

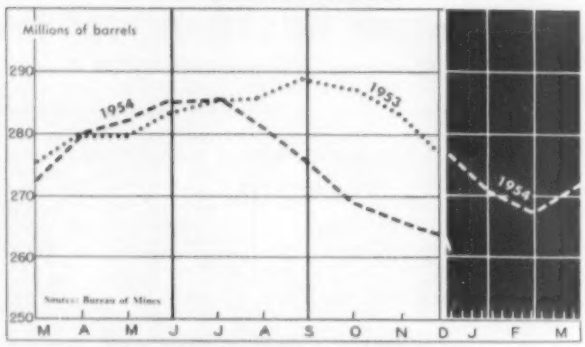


DAILY AVERAGE PRODUCTION FOR WEEK

	January 8			Jan. 1
	Crude oil	Lease condensate	Total	total
Alabama	4,200	.....	4,200	3,900
Arkansas	72,200	400	72,600	72,150
California	963,700	.....	963,700	964,300
Colorado	139,300	.....	139,300	143,300
Eastern	51,900	.....	51,900	51,800
Florida	1,450	.....	1,450	1,400
Illinois	205,600	.....	205,600	196,600
Indiana	29,200	.....	29,200	29,300
Kansas	297,900	.....	297,900	311,800
Kentucky	39,200	.....	39,200	38,800
Louisiana	632,850	53,000	685,850	644,850
North	100,850	3,000	103,850	103,350
South	532,000	50,000	582,000	541,500
Michigan	32,700	.....	32,700	31,900
Mississippi	90,700	3,775	94,475	93,300
Montana	36,100	.....	36,100	35,200
Nebraska	23,800	.....	23,800	23,500
New Mexico	213,800	2,625	216,425	215,100
North Dakota	26,700	.....	26,700	23,400
Oklahoma	459,700	.....	459,700	484,900
Texas	2,861,000	52,975	2,913,975	2,707,700
Dist. 1	46,000	450	46,450	46,475
Dist. 2	149,000	8,075	157,075	145,300
Dist. 3	446,700	25,150	471,850	441,000
Dist. 4	252,000	6,175	258,175	240,125
Dist. 5	50,700	525	51,225	43,500
Dist. 6	123,700	5,500	129,200	119,500
East Texas field	240,500	.....	240,500	216,100
Dist. 7-B	140,800	25	140,825	129,525
Dist. 7-C	179,600	4,550	184,150	179,550
Dist. 8	958,000	1,925	959,925	869,975
Dist. 9	189,000	575	189,575	192,625
Dist. 10	85,000	25	85,025	84,025
Utah	4,300	.....	4,300	4,400
Wyoming	257,400	.....	257,400	258,100
Others	‡300	.....	‡300	300
Total U. S.	6,444,000	112,775	**6,556,775**	6,336,000
Change from previous week, up			**220,775**	
Canada	†257,150	.....	†257,150	†293,575
Total U. S. production January 1-January 8				52,233,425 bbl.
Same period last year (crude plus cond.)				*49,791,970 bbl.

*Includes 784,450 bbl. condensate. †Week ended previous Monday. ‡S. D. 100, Nev. 200.

CRUDE-OIL STOCKS



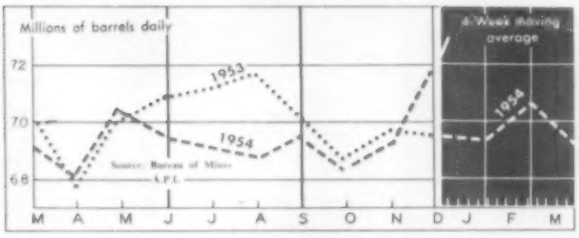
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

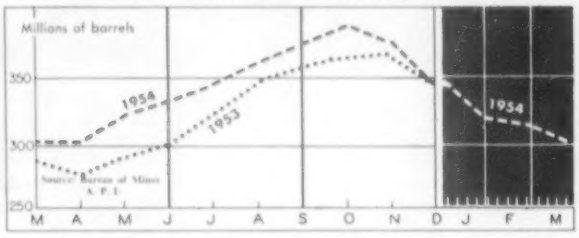
	Jan. 1, '55	Dec. 25, '54	Jan. 2, '54
Pennsylvania Grade	2,961	3,022	2,676
Other Appalachian	1,653	1,908	1,513
Illinois, Indiana, Michigan	11,800	12,139	12,144
Nebraska, North Dakota	1,721	1,800	(‡)
Kansas	8,657	8,643	8,766
Oklahoma	25,204	25,617	25,737
Arkansas	3,278	3,025	3,309
Louisiana	14,428	15,527	15,919
North	2,283	2,478	2,563
South	12,045	13,049	13,356
Mississippi	2,897	2,687	3,305
New Mexico	8,166	8,662	9,214
Texas	118,564	119,775	127,241
East Texas proper	9,899	10,173	11,571
West Texas	52,830	54,360	54,392
Texas Gulf	23,258	23,059	26,464
Other Texas	32,577	32,183	34,814
Wyoming	13,980	14,416	13,730
Other Rocky Mountain	5,309	5,254	2,902
California	31,249	31,707	34,048
Foreign	†11,619	11,189	10,265
Total	261,486	265,391	270,769

*Bureau of Mines. †Includes 3,270,000 bbl. in California. ‡Included with Kansas.

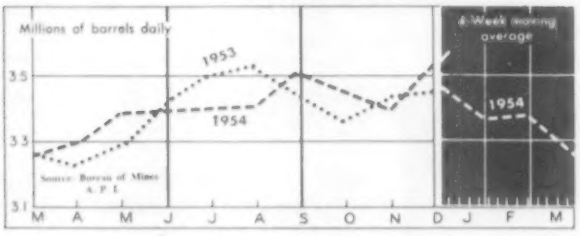
REFINERY RUNS



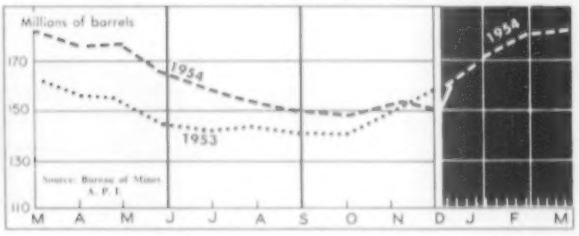
FOUR-PRODUCT STOCKS



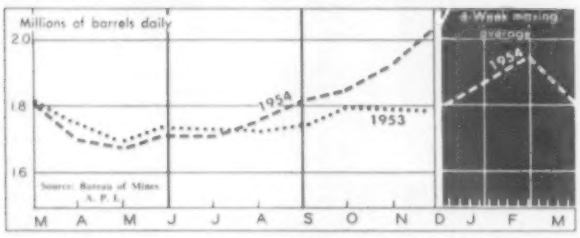
GASOLINE PRODUCTION



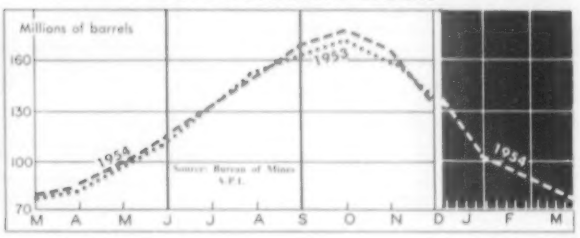
GASOLINE STOCKS



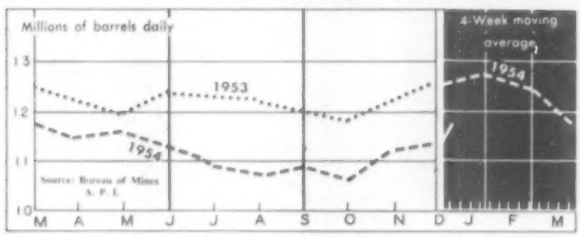
MIDDLE-DISTILLATE PRODUCTION



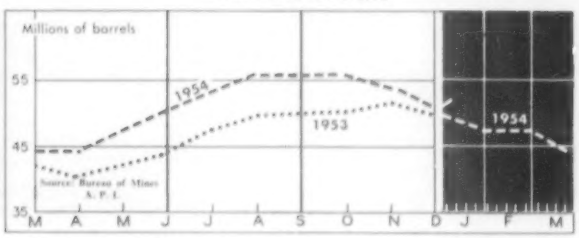
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, JANUARY 7

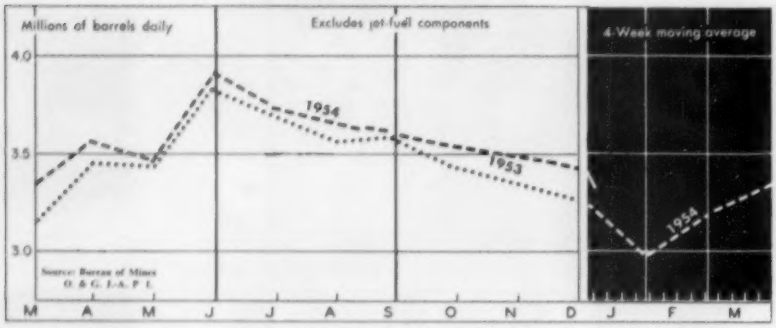
(Excludes all jet fuel components)

(Thousands of barrels)

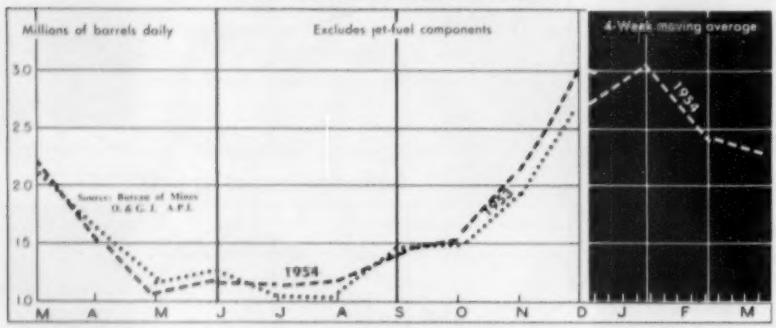
District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, January 1954 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,043	467.6	42.2	303.0	284.6	32,290	11,881	37,989	9,472	1,043	424.7	40.0	253.2	253.4
Appalachian:														
District 1	100	43.9	7.7	23.7	7.0	4,753	622	2,098	599	117	47.0	7.0	26.4	15.6
District 2	81	39.1	5.7	15.9	12.1	2,330	371	731	204	95	49.4	7.6	17.1	15.1
Ind., Ill., Ky.	1,352	711.3	77.1	303.6	189.6	35,135	7,549	18,879	3,615	1,310	692.6	86.5	241.9	193.7
Okla., Kans., Mo.	665	382.7	13.9	161.6	48.1	15,630	1,825	10,804	1,293	569	345.0	13.1	130.4	51.9
Inland Texas	251	172.4	7.6	49.1	20.3	5,952	394	1,826	1,337	241	169.0	13.5	37.3	30.6
Texas Gulf Coast	1,842	846.0	168.7	503.0	244.3	23,846	2,649	13,632	4,296	1,643	749.0	135.7	388.1	228.4
La. Gulf Coast	592	310.4	66.9	164.0	26.9	11,656	1,821	3,942	1,090	551	263.9	65.5	143.7	44.8
N. La. and Ark.	91	38.9	6.7	24.0	7.4	4,123	722	1,276	133	85	37.8	8.5	20.5	7.6
Rocky Mountain:														
New Mexico	19	11.0	0.3	3.1	2.9	198		89	35	19	12.0	1.0	2.5	3.3
Other Rocky Mt.	246	117.7	4.1	60.9	37.0	6,285	233	2,183	826	229	116.6	4.4	48.3	41.3
California	1,107	486.4	5.4	165.8	387.8	18,758	398	11,683	29,165	1,045	446.8	7.1	157.5	385.2
January 7, 1955	7,389	3,627.4	406.3	1,777.7	1,268.0	160,956	28,465	105,132	52,065	6,947	3,353.8	389.9	1,466.9	1,270.9
December 31, 1954	7,296	3,617.0	372.3	1,692.3	1,187.3	157,228	29,281	109,631	51,361					
January 9, 1954	6,960	3,447.7	389.9	1,478.0	1,228.4	160,324	28,204	106,341	49,668					

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipe lines.

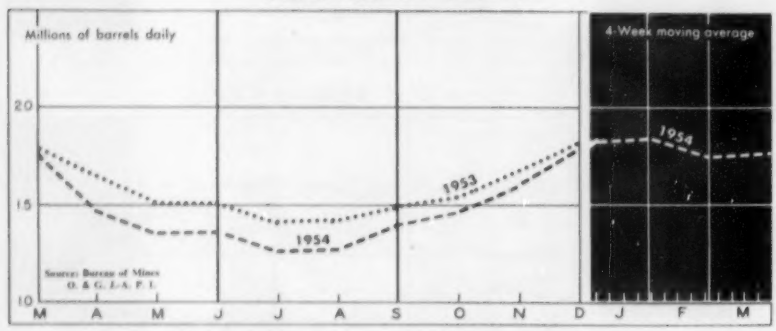
TOTAL GASOLINE DEMAND



TOTAL MIDDLE-DISTILLATE DEMAND



TOTAL RESIDUAL DEMAND



REPRESENTATIVE QUOTATIONS

Spot-market quotations of leading suppliers as of January 12, 1955. Prices are in cents per gallon, except for residual in dollars per barrel and wax in cents per pound.

GASOLINE, KEROSINE, AND FUEL OILS

	Mid-Continent Group 3	New York Harbor (barge)	Texas Gulf Coast
Regular gasoline	10.25-11	11.25-12	10.50-10.75
Premium gasoline	11.25-12	13-13.75	11.50-11.75
42-44 w.w. kerosine	9.75-9.875	10.7	9.5-9.75
No. 2 straw fuel oil	8.875-9.0	9.95	9.0-9.25
No. 6 residual	$1.50-1.60	$2.35-2.45	$1.85-1.95

NATURAL GASOLINE

	Group 3	North Texas	N. La.
Grade 26-70	5.5	5.0	5.25
Grade 18-55	6.6	6.1	6.35

LUBRICATING OILS

Mid-Continent

150-160 vis., D bright stock, 0-10 pp.	18
200 vis., No. 3 neutral, 0-10 pp.	13.25

WAX

Mid-Continent

132-134 A.M.P.	6.0

• The spread between the barge price for light fuels in New York Harbor and the delivered price for a spot cargo from the Gulf Coast not only has shrunk but has shifted to a minus. Spot charter rates are up without a change in the barge quotations.

PRODUCTION AND DEMAND—MAJOR PRODUCTS

(Thousands of barrels daily)

	Refinery prod.	Total demand
Gasoline:		
Four weeks ended 1-7-55	3,570	3,305
October 1954	3,457	3,515
December 1953	3,453	3,253
January 1954	3,354	2,985
Middle distillate:		
Four weeks ended 1-7-55	2,100	2,999
October 1954	1,854	1,513
December 1953	1,794	2,707
January 1954	1,857	3,076
Residual fuel:		
Four weeks ended 1-7-55	1,180	1,808
October 1954	1,066	1,448
December 1953	1,247	1,809
January 1954	1,271	1,831

CRUDE PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.*	Oklahoma, Kansas	Gulf Coast Tex.†	West Tex.‡
14-14.9	$1.87	....	....	....
15-15.9	1.93	....	....	....
16-16.9	1.99	....	....	....
17-17.9	2.05	....	....	....
18-18.9	2.11	....	....	....
19-19.9	2.18	....	....	....
20-20.9	2.24	$2.50	....	$2.37
21-21.9	2.30	2.52	....	2.39
22-22.9	2.37	2.54	....	2.41
23-23.9	2.45	2.56	....	2.43
24-24.9	2.53	2.58	$2.91	2.45
25-25.9	2.61	2.60	2.93	2.47
26-26.9	2.69	2.62	2.95	2.49
27-27.9	2.76	2.64	2.97	2.51
28-28.9	2.83	2.66	2.99	2.53
29-29.9	2.91	2.68	3.01	2.55
30-30.9	2.97	2.70	3.03	2.57
31-31.9	3.04	2.72	3.05	2.59
32-32.9	3.12	2.74	3.07	2.61
33-33.9	....	2.76	3.09	2.63
34-34.9	....	2.78	3.11	2.65
35-35.9	....	2.80	3.13	2.67
36-36.9	....	2.82	3.15	2.69
37-37.9	....	2.84	3.17	2.71
38-38.9	....	2.86	3.19	2.73
39-39.9	....	2.88	3.21	2.75
40 and above	....	2.90	3.23	2.77

*Standard Oil Co. of California. †Upper Texas Gulf Coast. ‡Sour. Includes New Mexico Permian.

Effective dates: California, February 16, 1953; east of California, June 15, 1953; Pennsylvania Grade, December 1, 1954.

FLAT CRUDE PRICES

Representative posted schedules per barrel.

Louisiana:	
Cotton Valley (distillate)	$3.00
Cotton Valley (Holloway crude)	2.95
Texas:	
East Texas	2.90
Chapel Hill	2.83
Conroe	3.13
Van	2.73
Pennsylvania Grade:	
Bradford	3.35
Middle District	3.25
Southwest Pennsylvania	2.93
West Virginia	2.82
Ohio	2.76
Illinois Basin	2.90-2.95

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FOR SALE—Horizontal Duplex Steam Pumps—10x8½x12—353 GPM—bronze fitted—max. discharge pressure 100 lbs.—6" suction—6" discharge—mfg. by American Marsh Co. Quantity available—NEW—Boston Metals Co. 913 E. Baltimore St., Baltimore 2, Md., Curtis 7-9050.

FOR SALE: ENGINE—165 Hp. Climax Model R61, maximum continuous Hp. rating 126 Herndon Drilling Company, 421 Mayo Building, Tulsa, Phone 4-9700.

CORE DRILLS-URANIUM. Power core drills for all depths. New and used spudders, rotaries, well drilling equipment and supplies. Compressors for air operation. Pressey & Son, Pueblo, Colo.

FOR SALE: Cooper Type 80 Direct Gas Engine Driven Compressors, AS IS or reconditioned Compressor cylinders all sizes. W. S. Smith, 205 Thompson Bldg., Tel. 2-5473, Tulsa, Oklahoma.

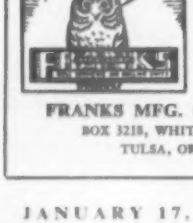
FOR SALE: Wilson Titan Drawworks, Serial No. 6539, Foster Catheads, Hydramatic Brake, All Chains, 3-Engine Compound & Gear Box, Excellent condition, or Will Consider Trading for Truck-Mounted Franks or Cardwell Rig for Workover. Southwestern Supply & Equipment Co., P. O. Box 14357, Houston 21, Texas.

Gaso Duplex 4½" x 6" Power Pumps with Chrysler C-38 Engines, skid mounted, immediate delivery. Also Byron Jackson, Carter Centrifugal Units. Westinghouse 20-25-50 KW Generating Units.

H. H. COFFIELD
Attn.: W. H. ORR
Phones: 132—Rockdale, Texas
AT-3427—Houston, Texas

USED EQUIPMENT

Two Franks Model 4000-TM Single Drum Well Servicing Units. Single Pole Mast. Truck Mounted.
Franks Model Super East Texas Single Drum Well Servicing Unit. Truck Mounted. Handles 6500' work.
Franks Model East Texas Single Drum Well Servicing Unit. Single Pole Mast. Truck Mounted. Handles 5000' work.
Two Cardwell Models K5 Single Drum Well Servicing Unit. Single Pole Mast. Industrial engine. Mounted on trucks.



50/60 Ideco Skid Servicing Unit. Double Pole Mast. Mounted on International Tandem Truck.
Franks SAL 4500 Skid Rotary Rig Cummins Power, 96' Derrick. Located, Tulsa, Oklahoma.
O.C.S. Type 3 Servicing Unit mounted on 1942 Mack Truck. Located Odessa, Texas.

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FRANKS MFG. CORPORATION
BOX 3218, WHITTIER STATION
TULSA, OKLAHOMA

FOR SALE EQUIPMENT

COMPLETE STOCK of Diesel & Gas Generator Units, 50 & 75 KW Caterpillar Diesels, Buda, Cummins, G.M., Waukesha, Hercules, Kohler, 5 to 100 KW, both AC and DC. Give us your inquiries. Southwestern Supply & Equipment Co., P. O. Box 14357, Houston 21, Texas.

SWEET GASOLINE Plant. Liquidation: Heat Exchangers—1530, 310, 265, 65, 26 sq. ft. Columns—84" x 30'; 72" x 28'; 72" x 16'; 60" x 24'; 48" x 24', 42" x 44'; 36" x 42'; 24" x 45'. Tanks—Storage & Pressure, 100 to 25,000 gal. Compressors—14 11 x 20, 300 PSI; 14/12½ x 20, 175 PSI; 13" x 16", 75 PSI—all gas driven. Pumps—Centrifugal—1½" to 8". Boilers—150 HP, gas fired, 150 PSI HRT. Misc.—Instruments, motors, stacks, pipe, etc. Heat & Power Co., Inc., 310 Thompson Bldg., Tulsa 3, Okla.—Phone: 3-4890. 70 Pine St., New York 5, N. Y.—HAnover 2-4890.

GASOLINE PLANT *FOR SALE*

Gasoline Plant, located in Brazoria County, Texas, shut down in January, 1954. Had been processing approximately thirty-three million feet of gas daily with absorber pressure approximately six hundred thirty pounds. Plant recovered Propane, Butane, Gasoline, Kerosene and Diesel Oil. Adequate storage tanks for all products. Drum Lead Blending Plant. Detailed inventory available upon request.

SOUTHERN PRODUCTION CO., INC.
P. O. Box 670, Ft. Worth, Texas

EQUIPMENT SPECIALS!

Columns: 8' x 28', 7' 6" x 56', 7' 4" x 70', 7' x 5' x 70', (2) 7' x 57' (400#), 7' x 42', 6' x 63', 5' x 62', 4' x 72', 4' x 47', (250#), 3' 6" x 63', 2' 6" x 60', 2' x 75', 2' x 45' (250#).

Heat Exchangers:

(5) 1,660 sq. ft. (Adm.), (2) 1,125 sq. ft. (850 lb.), 1000 sq. ft., 600 sq. ft. (Adm.), (5) 424 sq. ft. (Adm.), (5) 360 sq. ft., (4) 260 sq. ft.
60—Turbine driven centrifugal pumps, SS & Steel, 1" x 1" to 8" x 8".
2—6-stage Pacific pumps 730 GPM, 2,000 ft. hd.
2—Clark MA-4 150 BHP engines.
4 IR XVG-8 engines.
Goulds 16" 10,500 GPM. Pump. 135 ft. hd.
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5' x 12', 4' x 6' Drum Flakers.
Lab. Petrochem Furnace.

Detailed circular upon request.

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FOR SALE: Trailer Mounted Mayhew Model 3000 drilling rig with 87' Mayhew Mast complete with traveling equipment, rotary table, drawworks, engine, and substructures; but, less pump, pipe, and tools. Ideal for slim hole drilling to 6000'. Reed Drilling Company, Inc., 1408 First National Building, Tulsa, Phone 2-9638.

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Petro. Industries Consultants, C.A. Caracas, Venez.

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Phone 2-3276

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Used Seamless STEEL TUBING

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1½" O.D.
2" O.D.
2½" O.D.
3½" O.D.
3½" O.D.
4" O.D.
5½" O.D.

Approximately 5 miles of each diameter available in single or double random lengths with beveled ends.

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Kansas City 18, Kansas
ATwater 9305

FOR SALE: 1—7¼" x 12" FZ-FXZ Gardner-Denver Pump unitized w/ Model 6LROU Waukesha Gasoline—Natural Gas—Butane Engine and 28A Demco Circulating Type Rod Oiler. Pump has been in use less than 90 days. Box H-545, The Oil and Gas Journal Tulsa, Oklahoma.

FOR SALE: National RB 7½ Double Drum Drawworks, with Hydramatic Brake, Chains; National Model 3426 Drawworks, with Chains. Southwestern Supply & Equipment Co., P. O. Box 14357, Houston 21, Texas.

FOR SALE: 3600' 4¼" extra hole drill pipe, good for shallow drilling, $.90 per foot. Terms. Melton Supply Company, Box 1386, Seminole, Okla.

TANKS FOR SALE
3—40,000 Bbl., 2—37,500 Bbl., 1—17,500 Bbl., 4—250 Bbl. Contact—Fairway Pipe & Supply Co., P. O. Box 6627, Cedar Grove Station, Shreveport, Louisiana, Phone 8-1473.

FRANKS MODEL 5000—Bargain: 1-Cummins HBI-600 engine in good condition equipped with spudding attachment, skid and 65' double leg (8⅝ x 7" legs) mast. Call Amherst 73311 Wichita, or write P. O. Box 1801, Wichita, Kansas.

FOR SALE—At our Oklahoma City warehouse, attention T. P. Mace, 13" used Harcraft Hydropneumatic Pumping Unit, complete. Complete details upon request. Cities Service Oil, Patridge, Bartlesville, Oklahoma.

EQUIPMENT WANTED

WILL PAY highest prices for used casing, used line pipe, abandoned leases, or other surplus lease equipment. Your idle producing equipment is worth dollars. Green Pipe & Supply Co., Box 1383, Tulsa, Oklahoma.

WILL CONSIDER buying or leasing used seismograph equipment and trucks. Must be in good condition and reasonably priced. Please give full description, prices and present location in first letter. Box H-565, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED: Failing 1500, or equivalent with long mast, large pump, and drill collars. Reply to Box 7064, Tulsa 18, Oklahoma.

DRILLING, Production Machinery, Spools, Tongs, Slips, Elevators, Preventers, Subs, Flanges, Tools, etc. Please advise price, condition, location. Representative will contact you. Box H-561, The Oil and Gas Journal, Tulsa, Oklahoma.

HELP WANTED

JUNIOR PETROLEUM ENGINEER: Oil Company in Kansas has opening for Junior Engineer in Petroleum Engineering Section. Duties will include maintaining an oil treating program. Facilities are available in the company to obtain experience in exploration, drilling and production. Applicant must have a degree in Petroleum Engineering or equivalent. Experience not a requirement. Write Box H-559, The Oil and Gas Journal, Tulsa, Oklahoma, giving personal qualifications and salary expected.

HELP WANTED

FOREIGN EMPLOYMENT. List of oil companies and drilling contractors showing where to apply for foreign jobs. OIML Co. Box 2603, Tulsa, Okla. $5.00 cash.

PIERCEMENT SALT-DOME, subsurface geologist needed for work involving Louisiana Gulf Coast problems. Excellent opportunity for highly experienced man. HUNT OIL COMPANY, Dallas, Texas.

EXPERIENCED EMPLOYEES, for all positions on seismograph field crews, wanted by aggressive, expanding geophysical company. Please give full details of education, experience, salary expected, in first letter. Box H-566, The Oil and Gas Journal, Tulsa, Oklahoma.

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"Top young man; major Co. experience in Mid-Continent area. Excellent opportunity with rapidly expanding Co. in Kansas and Colorado. Contact Personnel Director, 352 N. Broadway, Wichita, Kansas.

ENGINEERS

for aggressive manufacturing company in midwest. Graduate engineers or engineering background, in design or development work for control equipment, used in oil and gas production. Organization also needs sales engineers experienced in above lines. Company offers excellent benefits with salary review every six months. Salary range $5000 to $7000. Company pays our service charges. All information confidential. Send resumes to

Chas. J. Loveless Personnel Service,
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GEOLOGIST

Rapidly expanding independent oil company has opening in Tulsa office for qualified sub-surface geologist. Must be particularly familiar with Mid-Continent area. Major oil company experience preferable. Must be well qualified to do mapping and logging interpretations, lease and deal recommendations. Age limit 35. Excellent position for right party. Give complete summary of experience and qualifications in letter. All replies confidential.

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—extensive experience pilot plant design, construction & operation. Must possess sound engineering background with extensive experience supervising personnel.

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—investigatioan & study pilot plant data. Well versed report writing & evaluation experimental data. Petrochem technical report writing desirable.

CHEMIST

—work on petroleum pilot plant operations and bench scale investigations. Experimental techniques on small scale laboratory experimentation is desired.

Excellent opportunities on pilot plant-research laboratory staff in Trenton-Princeton, New Jersey area.

Interviews arrange with Laboratory Director. Mail confidential, complete chronological resume, including education & employment (names & addresses of employers, dates employed, positions held & scope of responsibility, salaries received, etc.), to

PERSONNEL DEPARTMENT:

HYDROCARBON RESEARCH, INC.
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TULSA, OKLAHOMA

EXPERIENCED and Capable Specialty Salesmen to sell valves to Production and Pipeline Divisions. Box H-568, The Oil and Gas Journal, Tulsa, Oklahoma.

JUNIOR CHEMIST: Major oil research company has opening in Tulsa laboratories for a recent graduate chemist. Duties will include laboratory work of a routine nature and field process chemical studies. Experience not a requirement but preferably should have a degree in inorganic or physical chemistry. Write Box H-567, The Oil and Gas Journal, Tulsa, Oklahoma, giving personal qualifications and salary expected.

PETROLEUM ENGINEER with Masters Degree, or Doctor's in Chemical, Mechanical, or Petroleum Engineering, for research and teaching in Reservoir Mechanics and related fields at rapidly growing Southwestern institution. Rank and salary open, twelve months employment possible, consulting work encouraged and available in immediate area. Applications will be kept confidential. Box H-570, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST: Independent desires subsurface geologist with Oklahoma and Kansas experience for general exploration. Give detailed personal and employment history in reply. Box H-576, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS, Executives, Technical Men Salaried positions—$6,000 to $30,000. This confidential service for outstanding men who desire a change of connection. Will develop and conduct preliminary negotiations without risk to present position. Send name and address for details. Tomsett Associates, 434 Frick Bldg., Pittsburgh 19, Pa.

SITUATIONS WANTED

GEOLOGIST—33. Family. 2 years seismic, 3 years subsurface with major in East—West Texas, now consulting, desires permanent responsible position with company or independent. Box H-577, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES & PUBLIC Relations Executive desires position with drilling, exploration or supply firm interested in top level representation in Fort Worth and contiguous territory. Box H-571, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED all around man, tool pushing, production superintendent, completions, workovers. Family man, 43 yrs. of age, sober. Best of references. Box H-569, The Oil and Gas Journal, Tulsa, Oklahoma.

MANAGEMENT WITH aggressive independent with opportunity to participate. Eighteen years experience, management land, production, and drilling departments. Box H-537, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST with six years experience, surface, subsurface, drilling, supervisory, consulting, desires employment with independent oil Co. Box H-578, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST-GEOPHYSICIST
AGE 31, five years major exploration experience and graduate study in West, Gulf Coast and offshore areas. Excellent references, location open, replies confidential. Box H-584, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PETROLEUM ENGINEER desires position with an independent oil company. Have had 15 years experience as engineer, production and drilling superintendent with major and independent operators. Box H-585, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

GEOLOGIST, six years South Texas experience, desires affiliation with active company. Box H-582, The Oil and Gas Journal, Tulsa, Oklahoma.

NEWSMAN, oil writer, 33, Spanish language background, seeks writing-public relations job in South America. Box H-579, The Oil and Gas Journal, Tulsa, Oklahoma.

ROYALTIES

FOR SALE—land owner oil royalty. Box 143, Powell, Wyoming.

ROYALTY, one-eightieth, section 596 and 597, Yoakum County, Texas, non-participating, for sale. Write Dr. J. A. Robinson, 233 21st Place, Santa Monica, Calif.

OFFERING CHOICE PRODUCING oil income royalties with large reserves per Dollar investments. A. S. Berry, 817 Wright Bldg., Tulsa, Okla.

WISH TO BUY producing royalty. Send details. Box H-574, The Oil and Gas Journal, Tulsa, Oklahoma.

WISH TO BUY producing royalties. Box H-579, The Oil and Gas Journal, Tulsa, Oklahoma.

JACK EAGLE, Oil Properties, 706 City Nat'l. Bld., Oklahoma City, Oklahoma, Telephone REgent 6-7027.

LEASE AND DRILLING BLOCKS

200 BBL. ONE WAY, 90 bbls. the other, both new wells across 40 acres. 90 acre lease, three small wells, good equipment. Pay in both Dutchers, oil below in Tyner. Paying 10% on $12,000.00 more than 10 years. Undrilled locations. L. Price, Coweta, Okla.

160 ACRE LONG TERM oil lease on producing dome, eastern Utah. Owner, R. Barnsley, 950 Lincoln Ave., Palo Alto, Calif.

HAVE OPTION and geological reports on substantial blocks of acreage in Oklahoma, Illinois, Missouri, and Clayton County, Iowa, all in shallow areas. Will block leases, furnish geology, and make locations for percentage of acreage. For complete details write J. R. Schulte, 818 W. 13th St., Tulsa.

WANTED TO SELL ¾ interest in 200 acres in 20-17-13 3400 barrels production ¼ interest $100,000.00. ⅛ interest $50,000.00. 1/16 $25,000.00. 1/32 int. $12,000.00. We will Escrow commitments with money in First National Bank, Coweta, Okla. Write O. A. Sewell, Coweta, Oklahoma. Subject to prior sale or withdrawal.

SEE A. L. BOWLES, Box 947, Ada, Okla., for drilling deals and producing royalties if you have the cash for Oil Investments.

Will pay cash instantly for lease (large blocks), royalties, mineral deeds, production. Write fully—P. O. Box 2153, Denver, Colorado.

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SETTLED OIL production wanted by independent operator direct from producer. P. O. Box 852, Oklahoma City, Oklahoma.

DEPLETED LEASES—Kentucky—Waltersburg, Tar Springs, Weir, Berea Sands—Complete details in reply. Box 2, Clarendon, Penna.

WANTED—IDEAS

Inventions that are related or can be adapted to the oil industry. We offer capital, technical advice, patent assistance, market research, a manufacturing plant, and a sales outlet; everything to put your invention on the market. Write P. O. Box 1085, Houston 1, Texas.

Will purchase producing oil properties of any size. This is direct contact with purchaser.

Send All Details To:—

MR. JACK DAVIS

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BUSINESS OPPORTUNITY

ORGANIZED GROUP of business men financially able to undertake uranium deals of unlimited size, operations, buying claims, active exploration, etc. You are dealing directly with us. Reasonable inquiries will receive prompt attention. Box H-587, The Oil and Gas Journal, Tulsa, Oklahoma.

NEW OIL COMPANY buying proven oil and gas production with incomes ranging from $25,000.00 to $300,000.00 per month. You are writing directly to company officials. Financial statement will be presented to responsible sellers, principals, and authorized brokers. Box H-586, The Oil and Gas Journal, Tulsa, Oklahoma.

ESTABLISHED Drilling Company wishes to contact investors with sufficient capital to finance an Oklahoma drilling program or in organizing an expanded drilling and producing company. Sooner Drilling Company, Suite 1009, American Airlines Building, Tulsa.

LEASE OWNER of acreage over Gas and Oil seepages needs financing to drill shallow wells in East Tennessee. Excellent structures. Gas markets nearby. Contact E. A. Munyan, 102 Fairview Drive, Fairfax, Va.

RECENTLY ORGANIZED Eastern group with venture money for drilling of wildcats development, farmouts. You are dealing directly with principals. Box H-588, The Oil and Gas Journal, Tulsa, Oklahoma.

RECENTLY ORGANIZED group seeking proven oil property with an income of $10,000 to $40,000 per month. You are writing directly to the principals. Prompt action Box H-536, The Oil and Gas Journal, Tulsa, Oklahoma.

PRINCIPAL WILL PURCHASE: Oil Property from Independent, or—Producing Oil Co. (stock or property),—Oil Royalty Co., either stock or property where Purchase Price Valuation is $200,000.00 and up.

Box H-547, The Oil and Gas Journal, Tulsa, Oklahoma.

CUBA, THE NEW OIL COUNTRY:

Activities are rapidly expanding. Many Independents are already drilling. We control large areas throughout the entire Island. We also have large blocks in the actual producing fields (Bacuranao, Motembo, Jarahueca and Jatibonico) the latest discovery made by Kerr-McGee Oil Industries. This Company will drill 3 wells in the Jarahueca Field. We will sell 1/64th of each well for $1,000.00. We wish to contact party with a complete small rotary, preferably Cardwell model H, truck mounted, willing to sell or receive an interest for the use of the equipment.

CUBAN OIL ENTERPRISES.
Aguiar 574 St. Havana, Cuba.

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LEGAL NOTICE

NOTICE OF SALE OF OIL, GAS AND SULPHUR LEASE

Pursuant to the provisions of Chapter 150 of the General and Special Laws of the State of Texas, passed by the 45th Legislature at its Regular Session, as amended by Senate Bill No. 248, passed by the 53rd Legislature at its Regular Session, the Board of Directors of the Agricultural and Mechanical College of Texas hereby offers for sale at public auction in the Office of the Comptroller, Room 201-D, System Administration Building, College Station, Texas, at 10:00 a. m. Thursday, February 24, 1955, the oil, gas, and sulphur lease on approximately two hundred sixteen and one-tenth (216.1) acres of land occupied by the Texas Forest Service, located near Conroe in Montgomery County, Texas, being out of the Edward Hall, J. L. Garwood and Thomas Miller Surveys and being that certain First Tract of land as described in a General Warranty Deed from the Estate of Richard H. John to the State of Texas dated June 18, 1926, recorded in Volume 118, Page 375, of the Deed Records of Montgomery County, Texas. Only cash bids will be considered. The right is reserved to reject any and all bids. For lease forms and particulars, address: Comptroller, Texas Agricultural and Mechanical College System, College Station, Texas.

Successful Wildcats

(Continued from page 168)

calculated open-flow potential, gas-condensate ratio 21,600 cu. ft. per barrel, 51°, perforations 8,927-36 ft., and 2,200 M.c.f. daily, calculated open-flow potential, gas-condensate ratio 23,400 cu. ft. per barrel, 49.8°, perforations 9,002-73 ft. (Wilcox-Schiller sand). TD 9,091 ft. (New pay 8,927-36 ft.) in Cecil Noble field.

DeWitt County: D. D. Feldman Oil & Gas Co. et al 1 Gohlke, J. Tinsley Sur., A-445. IP 2,973 M.c.f. daily and 24.6 BCPD, 14/64-in., 70°, upper Wilcox 7,324-25 ft. (perforations). TD 7,707 ft. (New field—3 miles southeast of Yorktown.)

Jackson County: Sun Oil Co. 1 McDaniel, Elisha Burton Sur., A-286. IP 39.9 BOPD (net), ⅛-in., perforations 5,868-80 ft. TD 10,000 ft. (New field—McDaniel Yegua.)

Wharton County: Caribbean Oil Corp. 1 Weaver, J. M. Brownson Sur. 22, A-797. IP 12,000 M.c.f. daily, open-flow poten-

tial, plus 16 BC per M.M.c.f. TD 7,220 ft. (New field in Louise area.)

J. M. Flaitz and R. B. Mitchell 1-B Cockburn, Lot 5, Block 80, S. A. Larche Sur., A-268. Shut-in gas well. TD 7,714 ft. (Extends Magnet field.)

EAST TEXAS

Panola County: Cosmopolitan Petroleum Co. 1 Augurs, Jacob Womack Sur., A-733, 1½ miles N Bethany. IPP 19 BOPD, Fredericksburg 2,441-86 ft., 35°. TD 2,509 ft.

WEST CENTRAL TEXAS

Coleman County: Bridwell Oil Co. 1 Cope, M. R. Tatum Sur. 741., 5 miles SE Coleman. IP 127.8 BOPD, 10/64-in., TP 180 psi., GOR 240, 40.5°, Breneke sand 2,024 ft. TD 2,028 ft.

Falcon Oil Corp. et al 1 Morris, 32-2-GH&H, 4 miles NE Silver Valley. IP 15 BOPD, 24/64-in., 39°, GOR 76,455, Morris sand 2,550-57 ft. TD 2,594 ft.

Fisher County: Sid Katz 1-C Wheeler, G. Creath Sur. 221, 8 miles NE Eskota. IPP 45.8° BOPD, 39°, GOR zero, pay 2,612 ft. TD 4,453 ft.

Jones County: Roy H. Smith Drilling Co. 1 Eason, 9-17-T&P, 10 miles SW Anson. IPP 77 BOPD, 38°, King sand 2,754-58 ft. TD 2,770 ft.

Nolan County: Hunt Oil Co. 1 Boyd, 44-X-T&P Sur., 5 miles NW Nolan. IP 211.7 BOPD, ⅛-in., TP 415 psi., GOR 675, 43°, Ellenburger pay 6,540 ft. TD 7,085 ft.

NORTH TEXAS

Clay County: Bobby M. Burns 1 Jones, M. Carabajah Sur., A-91, 1 mile NE Henrietta. IPP 45 BOPD, 43°, Caddo perforations 6,226-29 ft. TD 6,351 ft.

Panhandle Oil Corp. 1-A Boddy, Mial Scurlock Sur., A-423, 8 miles E Henrietta. IPP 54½ BOPD, 40°, Vogtsberger 4,873-77 ft. TD 5,128 ft.

Young County: Ada Oil Co. 1 Taack, Blk. 285, TE&L Sur., A-532, 4 miles SW Jean. IP 192½ BOPD, 20/64-in., TP 300 psi., GOR 385, Strawn 3,693-99 ft. TD 3,750 ft.

WEST TEXAS

Scurry County: Union Oil Co. of California 1 Simmons, 138-2-H&TC, 16 miles NE Snyder. IPP 79½ BOPD, pay 6,370 ft., 43.5°, GOR 610. TD 7,320 ft.

MICHIGAN

Allegan County: Monarch Oil Co. 1 McIntosh & Culver, S½ NE SE 10-2n-13w. IPP 2 BOPD, Traverse lime 1,470 ft., pay 1,472 ft., TD 1,474 ft. (New pool.)

PENNSYLVANIA

Indiana County, In Banks Township: Keta Oil & Gas Co.-Columbian Carbon Co. 1802 Farmers & Miners Trust Co., 431,000 cu. ft. gas, rock pressure 3,820 psi. in 42 hours, chert 7,488 ft., Oriskany sand 7,564 ft., TD 7,600 ft.

SOUTH LOUISIANA

St. Mary Parish: Shell Oil Co. 1 State Lease 1665, Block 13, Eugene Island Area, Gulf of Mexico. IP 220 BOPD, 10.64-in., 35.1°, perforations 9,075-78 ft. TD 11,500 ft. (New pay in Eugene Island Block 18 field.)

Terrebonne Parish: Arkansas Fuel Oil Corp. 2 Southdown Sugars, 81-17s-16e. IP 2,418 M.c.f. daily, 9/64-in., spray condensate, perforations 12,519-22 ft. (Krumbhar sand). TD 12,585 ft. (Extends Crescent Farms field.)

Superior Oil Co. 3-A Continental, 36-17s-13e. IP 10,300 M.c.f. daily, 24/64-in., dry gas, perforations 9,126-35 ft. TD 11,200 ft. (New pay in Kent Bayou field.)

NORTH LOUISIANA

Caddo Parish: Stanolind Oil & Gas Co. 1 Hunter, C NE SW 28-17n-16w. IP 8,240 M.c.f. of gas per day, plus unestimated amount of condensate. "D" sand of Cotton Valley 8,515-70 ft. TD 8,962 ft. This is an old well drilled deeper. Extends Greenwood-Waskom field.

DeSoto Parish: Natural Gas & Oil Co. 1 Holmes, 21-13n-16w. IP 5,900 M.c.f. of gas per day plus 1.5 BC per million, Rodessa 5,364-68 ft. TD 6,743 ft. Unnamed gas discovery.

Ouachita Parish: Carter Oil Co. 1 Rhymes-McGuire, C NE SW 23-17n-4e. IPF 5,000 M.c.f. of gas per day, ⅜-in. choke, Upper Pettit 5,079-84 ft. TD 6,305 ft. New pay in Bridge Brake field.

KANSAS

Barber County: Purcell & Mull 1 Burns, NW NW NE 23-33s-11w. IPP 20 BOPD, Miss. 4,496-4,514 ft. TD 4,610 ft. (Opens East Rhodes pool.)

Rush County: Republic Natural Gas Co. et al 1 Webs "C," NE NE NE 16-19s-20w. IP 3,000 bbl. of oil per day, Cherokee 4,202-12 ft., 4,216-18 ft. TD. 4,700 ft. (Opens Webs pool.)

NEBRASKA

Kimball County, Vrtatko: Rock Hill Oil Co. and Twin Oil Corp. 1-A Vrtatko, NE NE SE 7-13n-54w. IPP 225 BOPD, "D" sand discovery, new field. TD 6,152 ft. "J" sand.

CALIFORNIA

Yolo County: Bandini Petroleum Corp. 1 Griffin, 1-8n-1w, IPF 8,000 M.c.f. gas daily, ⅞-lb. choke, 2,032 psi. flow pressure, McCune 4,712-25 ft. TD 4,900 ft. (New fault block pool in North Winters field.)

MONTANA

Fallon County, East Baker: Monoco Oil Co. 1 Ferguson-Goldin, C N½ SE SW 13-7n-61e. IPF 132 BOPD, 20/64-in., Ordovician discovery, new field. TD 9,285 ft. Red River.

COLORADO

Logan County, Coyote field: Shell Oil Co. 1-A State 694, C NW SE 12-6n-53w. IP 2,250 M.c.f. of gas per day, Muddy discovery, new field. TD 4,690 ft. Dakota.

MANITOBA

Dome et al 13-26 South Harmsworth, LSD 13, 26-11-26w1. Lodge pole oil well. TD 2,031 ft.

SASKATCHEWAN

Canadian Gulf-Canadian Devonian 5 Walter, LSD 5, 14-5-6w2, Charles oil well. TD 7,607 ft.

Tide Water-Ajax 4 White Bear, LSD 9, 12-9-3w2. Indicated Mission Canyon oil well. TD 4,962 ft.

BRITISH COLUMBIA

Pacific-Sunray 2 Montney, LSD 14, 36-86-19w6. Triassic gas well. TD 6,442 ft.

Equipment Men

Heroy Named to Board of Diamond Oil Well Drilling

W. B. HEROY

William B. Heroy has been elected to the board of directors of Diamond Oil Well Drilling Co., Midland, Tex.

Heroy was formerly chief geologist with Sinclair Oil Corp. Since that time he has had extensive experience in the federal petroleum administration serving as both chairman of resources and director of foreign production, and special assistant to the secretary of the interior. He is now president of Geotechnical Corp. and partner in the geophysical and engineering consulting firm of Beers & Heroy.

Heroy attended the recent directors' meeting of Dowdco in Midland which was also attended by Alexander Fraser, former president of Shell Oil Co.; Robert N. Arthur, vice president of Mercantile Trust Co., St. Louis; Henry W. Hoagland, treasurer of American Research & Development Co., Boston; and Piet Smit and Herman Meinert, president and general manager respectively of J. K. Smit & Sons, Inc., New Jersey, manufacturers of diamond bits distributed by Diamond Oil Well Drilling.

Swartwout Names Wagner to Southwest District Sales

Appointment of A. Ray Wagner as Southwest district resident sales and service engineer has been announced by Swartwout Co., producer of process control, power plant, and industrial ventilation equipment. Wagner is well known in the instruments field. He has been associated in both sales and service by several large instrument manufacturers, as well as with large users in the chemical process field. Wagner who will work out of the Houston regional office of Swartwout will make his headquarters in Tulsa.

Kaiser Shifts Anthony to Key Central District Post

Mark T. Anthony has been named assistant manager, central district sales, for Kaiser Steel Corp., it has been announced by C. L. Emerson, Jr., gen-

Delta-Desco Holds Annual Sales Meeting

Delta Engineering Sales Co. and Desco Service Co. recently held a joint sales meeting at the main office in Shreveport, La., to discuss future operations and plans for both companies. All phases of valve-lubricating equipment, as well as valve servicing, were discussed. Delta Engineering announced major improvements in its valve lubricants, and Desco Service revealed new types of valve-servicing equipment for the industry. Photographed at the meeting were, standing: Tom Hughes, Baton Rouge, La.; Vernon Neyland, Tulsa; J. L. Barthold, Shreveport. Seated: George Morgan, Los Angeles; T. D. Chantler, office manager; L. V. Wade, Houston; Paul E. McKenna, manager, Desco Service; R. D. Lindsay, sales manager, Delta Engineering; C. F. Clure, general manager; J. P. French, Odessa; and L. E. Myers, Amarillo.

eral sales manager. His offices will be in Oakland, Calif.

Anthony joined Kaiser Steel in 1946 as assistant to the market consultant. Until this new appointment, he has been serving as assistant director, general planning. Previously he was with Congoleum-Nairn as office manager and sales representative.

Welex Opens Service Office at Bartlesville

With the opening of a new, completely equipped serviced office in Bartlesville, Okla., Welex Jet Services, Inc., originators of the jet process of oil-well perforating, offered their complete line of services to local oil producers.

The new office will specialize in radioactivity well logging, jet perforating, permanent type completions, and formation fracturing as well as other Welex services.

Manager of the new Welex office will be George C. Thomas, Jr., formerly assistant district manager for the oil-well service company in Ardmore, Okla.

Abrams Names Bayless to Head Oil-Industry Business

John C. Bayless is the newly appointed oil-industry manager for Abrams Aerial Survey Corp., Lansing, Mich. He was educated at the University of Michigan where he received B.S. and M.S. degrees.

Bayless has taught at Michigan State College and was geologist with Texas Co. in Montana before joining the Abrams firm. He did consulting work in the Rocky Mountain area before joining Texas.

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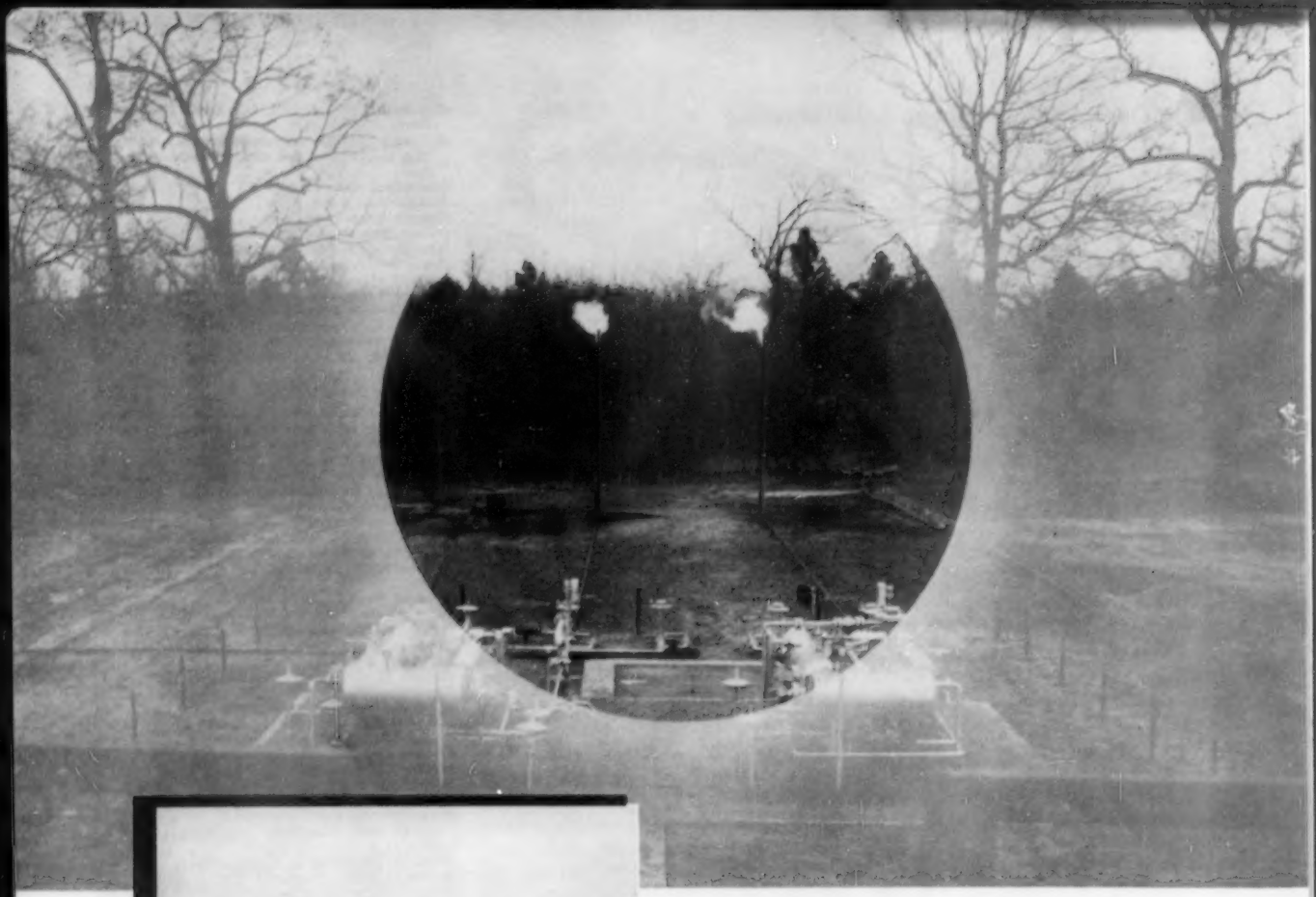

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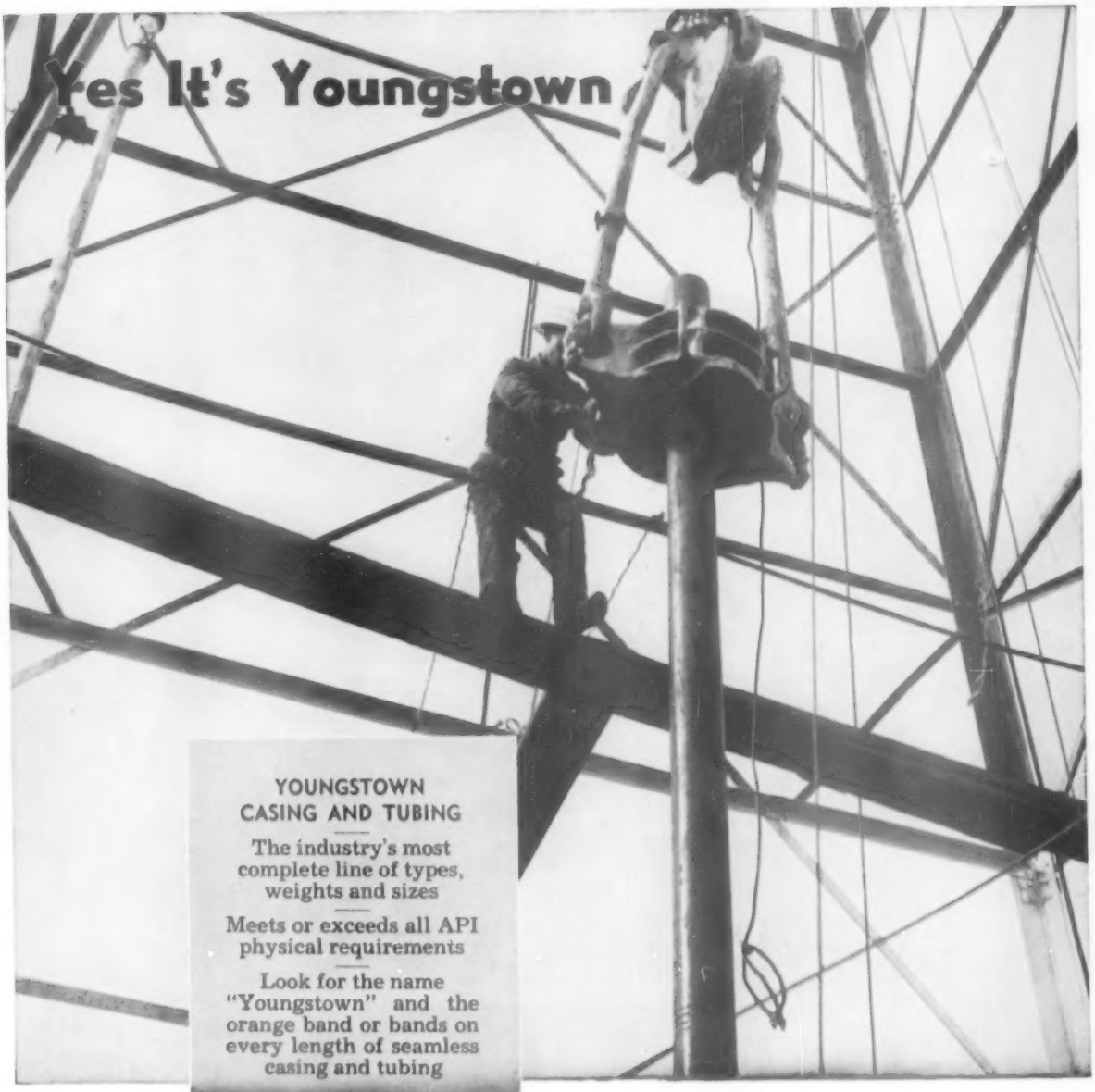

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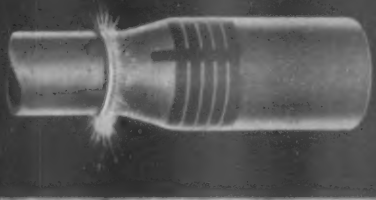

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